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A PLEA FOR TREE PLANTING AND TREE PRESERVATION.

J. M. Reed, I.S.O., Surveyor-General.

"Jock, when ye hae naething else to do, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping."—*The Heart of Midlothian*, Chap. 8.

Even to the most casual observer, when travelling over a great part of the State of Victoria, the absence of tree shelter on farms and grazing lands is very evident, and it is surprising that so many land-owners fail to recognise the great importance of tree-planting. If the authorities of this State, when disposing of Crown lands, had made compulsory provision for the maintenance of timber growth, or the planting of trees on a percentage of the area of every holding, it would have been a great benefit, and if farmers could be made to realise the direct gain to themselves by meeting this requirement, much good would result. The progress of settlement has necessarily involved the destruction of an immense quantity of timber, and, as our own experience has clearly proved that rainfall conditions are largely affected by tree cover, it may be accepted that the one cannot be removed without prejudice to the other. Many predictions of ultimate disaster from the clearing of our timbered lands have been uttered, but, without accepting these, it may be asserted that nothing but good can result from generous tree propagation.

On many of the large estates in the Western District, where shelter for stock was found to be indispensable, more or less extensive tree-planting has been undertaken. Unfortunately, the blue gum was the tree most favoured in earlier years, and experience has showed it to be a decided failure. The substitution, in later years, of the sugar gum, which is now generally grown, has proved very satisfactory. Titanga estate, near Lismore, is probably the most striking object-lesson in Victoria, as showing the excellent results of systematic tree-planting. The late Mr. J. L. Currie, of Larra estate, who also owned Titanga, initiated this good work, and, appreciating its great value, made a special study of the different variety of eucalypts, of which he formed numerous plantations. The

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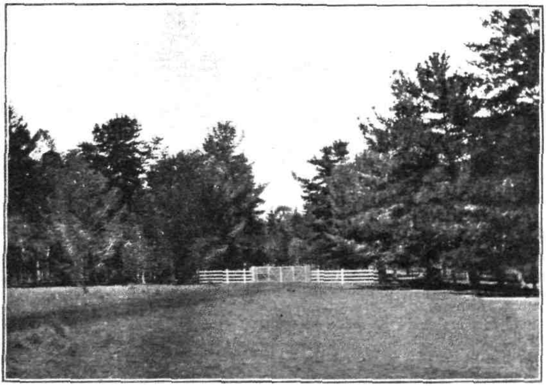
present owner, Mr. P. S. Lang, who has for many years carried on the work of his predecessor, is an enthusiastic advocate of tree-planting, and, under his care, this tract of country, which was to a great extent devoid of timber, has been quite transformed. It now presents a most attractive appearance, owing to its park-like effects, and numerous vigorous plantations, covering an area of over 700 acres. Illustrations 1, 2, 3, and 4 apply to this estate. Another very striking illustration is that of the sewage farm of the Melbourne and Metropolitan Board of Works. When first occupied, about fifteen years ago, this property was almost treeless, and, by a well-devised scheme of planting, nearly 400 acres of well-established plantations have been formed. An experience of the Werribee Plains on a cold, wet day, with south-westerly winds, will serve to emphasise the wisdom of this action. Illustration No. 7 represents a home on the Werribee Estate; the first planting was done 13 years ago, and has been added to year by year. The owner, Mr. J. Brown, has this season planted 200 sugar gums.



1. MAIN ENTRANCE, TITANGA ESTATE. PINE TREES AND GUMS, PLANTED ABOUT 18 YEARS.

While many owners have carefully selected and preserved good shade trees on their properties, and others have been careful to form plantations, large numbers have had but the one idea, to clear the land for present use, without any regard to future wants. Even fine shade trees on country roads have too often been ruthlessly sacrificed to the greed of the land-owner, who could not endure a light growth of crop or grass on a few yards of his land as a result of the existence of fine overhanging trees. Shire councils could render good service by resolutely protecting timber growing on roads. Along river and creek frontages, too, there has been wholesale destruction of matured shade trees, and, though distinctly illegal, hundreds of owners have assumed to themselves the right of clearing to the bank of the stream. The value of cover along the water frontages is not recognised as it should be. For the prevention of erosion of banks, and the preservation of the

purity of the water, there can be no question that protective measures are required, and a general order forbidding the clearing of river and creek reserves, unless specifically authorized, would be a wise step, and would tend to check this abuse. Though the statement may appear to be an exaggeration, it is a fact that on many of the at one time forest blocks of South Gippsland there is scarcely a green tree to be found, while on some it is now a matter of difficulty to obtain fencing material. The settler has simply destroyed all the native growth, and the sooner replanting is begun the better for the settlement.

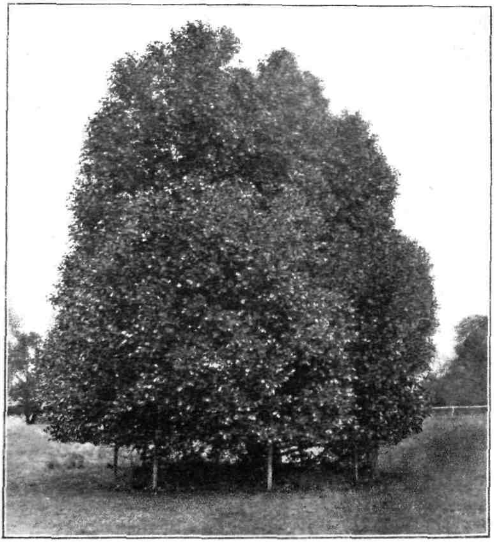
It is a great mistake to regard the land comprised in plantations as wasted. On the contrary, the value of the protection to both crop and stock far outweighs that of any area so utilized. Year by year in many districts fencing material and firewood supplies are becoming more costly, and State reserves from which they have been drawn are gradually being

2. SPECIAL PLANTATION OF DIFFERENT VARIETIES OF EUCALYPTS SOWN 1889, SHOWING FREE GROWTH OF SUGAR GUMS.

exhausted. While for the supply of towns and for the purposes of mining and other industries the State reserves must be depended on, it is certain that, unless land-owners take steps to provide for their own needs, they will in a short time experience great difficulty in obtaining their supplies, and the question may appropriately be asked. Why should the State be expected to provide for the timber requirements of those land-owners who, by a wise foresight, can themselves make such provision?

Victoria is a small State, and, as the demand for land is very pressing, the tendency must be to limit the area under reservation. Bearing in mind the small area of good land now available, and the keen competition for land for occupation, it is fairly certain that many of the existing reserves will, as they are denuded of timber supplies, have to be utilized for settlement. The proposed forest legislation will, it is hoped, result in more

effective control, and promote the development of forest lands by the closing and renewal of forests; but, no matter how effectively this may be done, there will still be the need for the work of the land-owner, and, though the individual contributions would be small, the aggregate would be great, and the benefits far-reaching. When dealing with Eurack estate, one of the properties acquired several years ago for closer settlement, the Lands Department introduced a stringent condition, requiring every settler to plant 2 per cent. of his area, or up to a limit of three acres, and this formerly



3. EUCALYPTUS ALPINA—A VERY BEAUTIFUL TREE.

treeless estate will no doubt in a few years illustrate the great advantage of tree-planting. The Land Purchase and Management Board has decided to apply this wise condition to the estates coming under its control.

In very many instances the neglect of tree-planting and the absence of shelter for stock amounts to positive cruelty. The sight of dumb animals exposed to the blazing summer heat or cold winter blasts, with no better shelter than is afforded by a boundary fence, is by no means uncommon, and the wonder is that owners do not recognise that in this they are responsible for quite unnecessary suffering, and, further, that they themselves suffer loss as a result of this lack of care for the animals on which they depend for their personal gains. Judicious tree-planting around homesteads and all farm buildings, in the vicinity of water storages, along exposed

boundary lines, in waste corners, or in clumps as screens for stock, would in a few years change the appearance of farm holdings, add to the comfort of the occupiers, give substantial profit to the owners, and invest our country lands generally with an added beauty and attraction. Illustrations Nos. 5, 6, and 7 show in striking contrast a cheerless unprotected Northern District home; a Gippsland home, with dead timber, but no attempt at home planting; a comfortable farm home, well screened by young trees.

The numerous and valuable agricultural societies in the State may reasonably be urged to assist in promoting this much-desired tree propagation. By the offering of premiums for the best-planted homestead a spirit of competition would be fostered, and the societies could in this way render a valuable service to the farming community.

The comparatively recent institution of Arbor Day in connexion with our State schools gives promise of much good. Both officers and teachers of the Education Department are showing a laudable interest in making this day a means of amusement and instruction to the pupils. A special Arbor Day number of *The School Paper* has been issued for several years,

4. SUGAR GUM PLANTATION $2\frac{1}{4}$ YEARS OLD.

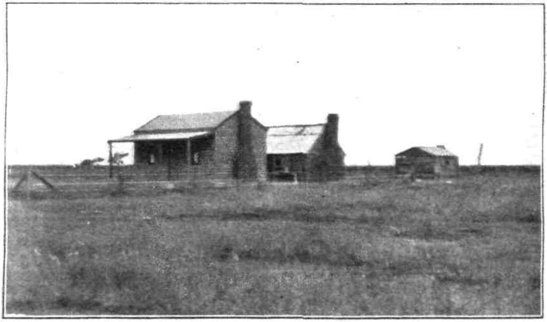
and by developing a love for trees on the part of the children the interest and influence will no doubt lead to home planting. Many of the municipal councils actively assist in this movement, and if Mayors and Shire Presidents generally would make Arbor Day a special feature of their terms of office, the combined efforts would prove very effective.

Summarising the advantages that may be claimed for individual systematic tree culture, the following may be noted:—

- The improved condition of the homesteads, both as regards the personal comfort of the occupiers and the attractiveness of the home.
- The improved condition of stock resulting from the comfort of effective shelter from the extremes of heat and cold.
- The increased returns from stock.
- The protection of cultivated lands by break-winds.
- The protection of pasture lands from the drying effects of strong winds.
- The increased value of farm lands. A well-planted farm is certainly the more valuable.
- The ultimate assured fuel supply and timber supply for farm purposes.

In the selection of trees land-owners should to a great extent be guided by local conditions, and from our numerous varieties of eucalypts there need be no difficulty in choosing suitable trees. One variety, the sugar gum (*Eucalyptus corynocalyx*), is the most vigorous grower of our native trees, and may be planted in any district. (See illustrations Nos. 2, 4, 8, and 9.) It is described as a good timber tree, and has been known to attain a diameter of 16 inches in seventeen years. Other good varieties are—*Eucalyptus calophylla*, known as red gum tree of South-Western Australia; *E. cornuta*, of South-Western Australia; *E. botryoides*, bastard mahogany of East Gippsland; *E. tereticornis*, red gum tree of Eastern Australia; *E. rostrata*, red gum tree of Southern Australia.

In Mildura very effective screens have been formed by alternating sugar gums and pepper trees. (See illustration No. 9.) As a shade tree the well-known pepper, which flourishes in the hot northern districts, is of great value. The *Pinus insignis* and other pines are also very suitable for stock shelter, and in form and foliage are very fine trees.



5. A CHEERLESS, UNPROTECTED NORTHERN DISTRICT HOME.

Another means of home improvement which is to be commended is that of hedge-planting. Both for ornamental purposes and as wind-breaks this is most desirable, and, with reasonable care and periodical trimming, a well-grown hedge becomes a very attractive feature of a country home. The African boxthorn is probably the plant most generally grown, but the tree lucerne is now finding favour. This has the merit of being a quick grower, and can be readily grown from seed, flowers freely, looks well, and, being free from thorns, can be very easily trimmed. Messrs. Hawkins and Hart, the poultry experts of the Department of Agriculture, describe it as the best shelter that can be introduced into a poultry run. Several varieties of cupressus may also be planted, and, with care and attention, made to form very fine hedge shelter.

The lines with which this paper is prefaced, taken from *The Heart of Midlothian*, are very appropriate to the subject. They were the advice given by "Dumbiedikes" on his death bed to his son, and Sir Walter Scott had the assurance that their publication so influenced a Scottish earl

as to lead him to undertake extensive tree-planting. It is hoped that they will similarly impress some at least of the readers of this *Journal*. It should always be remembered that *time* is the great factor in tree production, and therefore time should not be lost.

By request, Mr. J. Johnstone, officer in charge of State Plantations, has kindly prepared the following notes *re* suitable trees and methods of planting. These notes, which are published in full, will afford an excellent guide to the grower.

TREES FOR SHELTER PLANTING, AND DIRECTIONS FOR PROPAGATING AND PLANTING.

Out of some hundreds of species now known to the arboriculturist, only a small number lend themselves to belt and screen planting on our treeless, wind-swept plains, exposed uplands, and coastal regions, where unchecked winds sweep inland, causing waste and destruction. As every hill, plain,

6. A GIPPSLAND HOME, WITH DEAD TIMBER, BUT NO ATTEMPT AT TREE PLANTING.

and coastal line has its own peculiar soil and climate, all of those must be considered, as well as the nature and habit of the trees to be planted. If this is not done, disappointment and death will be the result.

For shelter, evergreen trees are, of course, the best. They should be strong, hardy, vigorous growers, and provide for the farmer material for his work and fuel for his fire, and at the same time beautify the home surroundings.

THE EUCALYPTS (GUM TREES).

This group is composed of evergreen trees, from which a few of the most suitable have been selected. Some of them, if planted singly, would make a noble shade in the open paddock for stock.

Sugar Gum (*Eucalyptus corynocalyx*).—This tree is well known for its general utility and early maturity. When properly pruned for shelter it is very effective. In growth it flourishes in a variety of soils and positions, but it is sensitive to frosts. Its dense dark green foliage and well-balanced, symmetrical habit, have made it a general favourite. Its timber is strong,

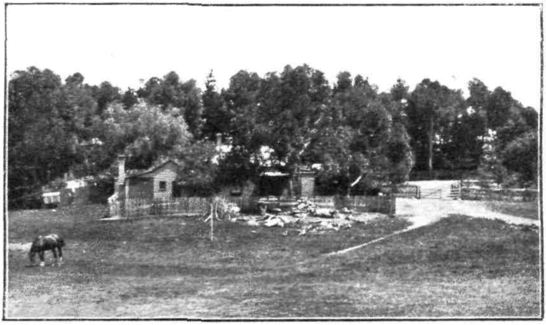
and, in addition to being excellent fuel, is suitable for many other useful purposes. As a timber tree it will grow to a height of 130 feet.

Red Gum (*E. rostrata*).—This valuable timber tree, with pendulous branches, affords a delightful shade. On river flats it grows largest. On the uplands their stems are much shorter, and their heads more spreading, and are perfect models of what a shade tree should be. More should be planted by the settlers, but not in belts. This tree can be raised open-root, and will transplant freely.

Yellow Box (*E. melliodora*).—This is a good shade-producing tree, and should be planted, but not extensively. On exposed areas in warm districts, where shade specimens are much in demand for stock, this tree should be planted.

Bastard Mahogany (*E. botryoides*).—It can be planted where the soil is saline. For belt planting it is not so good as the sugar gum.

Blue Gum (*E. globulus*).—Where the climate is cool, and the soil fairly



7. A COMFORTABLE FARM HOME WELL SCREENED BY YOUNG TREES.

good, the blue gum can be planted in blocks by themselves. As shelter belt trees they are an absolute failure.

HARDY CONIFEROUS TREES (PINES).

This genus is most important for general planting. *Pinus insignis*, the remarkable pine of California, is a handsome, hardy, fast-growing tree, and will do well in any kind of soil. As an all-round shelter tree we have nothing its equal. In the way of relief, *P. inops*, *P. densiflora*, *P. Halepensis*, the *P. laricio* family (noted for their timber and rapid growth), *P. contorta*, *P. resinosa* (the red pine), and *P. Canariensis* could be planted. The *Cupressus torulosa* and *C. Lambertiana horizontalis* are to be recommended. They make good trees and hedge screens, and do well in dry districts, and so will the *Schinus Molle* (pepper tree), and the last-named, if planted in line and cut back in spring, will form a graceful weeping wind-break round out-buildings and dwellings. The *Robinia Pseudacacia* (locust acacia) is a good yard shade. The carob tree (*Ceratonia Siliqua*) is a useful and profitable tree to plant, and so is the tree lucerne.

TREES SUITABLE FOR SALINE SOILS AND MARITIME SITUATIONS.

Eucalyptus gomphocephala, E. goniocalyx, E. botryoides, and in places *E. corynocalyx, Pinus Halepensis* (Aleppo pine), *P. Laricio* (Corsican pine), *P. pinaster* (maritima pine), *P. densiflora* (Akamatsu pine), and where suitable *P. insignis, Cupressus Nutkaensis, C. Lambertiana horizontalis* (from cuttings are best), *Ficus macrophylla* (Moreton Bay fig). On the coastal sands can be planted the *Myoporum, Acacia, Tamarix, Leptospermum* (ti-tree), and *Casuarina* families.

METHODS OF PROPAGATING.

The natural way is by seed. The *Tamarix, Myoporum*, and *Cupressus* can be raised from cuttings, and should be. Every settler on the land should have a small plot for the raising of his own trees. The site should

8. SUGAR GUMS ON EXPLOSIVES STORAGE RESERVE, NEAR SEA COAST, LAVERTON, ABOUT 5 YEARS OLD.

be fairly well sheltered, with a light sandy loam soil. The ground should be well dug, lined out in 4 or 5 feet beds, and then raked to a fine surface. The pine seeds should be soaked in cold water, and allowed to swell. The water should then be drained off, and the seed placed under cover for a few hours. Drill lightly the beds in three or four lines, and sow the seed straight away in the drilled lines, and cover up with the back of a light rake. If the soil is dry, water well with watering can and fine rose, and keep the ground moderately moist. In ten or eleven months' time the seedling plants should be lifted, and transplanted in nursery lines, 3 to 4 inches apart and from 14 to 18 inches between the rows. In this position they can remain for one or two years. They will then be large enough to remove to their permanent quarters. The sowing should be done during August and September, but this depends on the season and district, the northern areas being first planted. In 1 lb. weight of pine seed there are from 19,000 to 90,000 seeds, the price of which can be obtained from any seed merchant.

The Raising of Gums.—The seed can be sown from September to November, in boxes, pots, pans, or open beds. If in open beds, in the absence of a cement bottom something in the shape of hardwood boards or sheet iron should be laid 7 or 8 inches below the surface to prevent the roots of the seedling gums from going down. The seed beds should be from 3 to 4 feet wide, with a fine smooth surface. Water the bed before sowing. Sow broadcast, after sifting with a fine sieve, in loamy soil, light and dry, with a little decayed leaf mould mixed; spread it lightly and evenly over the seed; water with a fine rose. A temporary screen over the gum beds would assist the seed and protect the plants. If boxes are

9. MILDURA STREET PLANTING. SUGAR GUMS AND PEPPER TREES ABOUT 12 YEARS OLD.

used they should be from 4½ to 5½ inches deep, with holes for drainage in the bottom. When filling the boxes, place over the holes (for open drainage purposes) curved pieces of crocks or charcoal. Fill in with moderately-sifted loamy soil to within 1½ inches of the top; water, sow, and cover the seed as directed for the open beds. As plants in boxes are liable to be drawn, great care must be taken to keep them exposed to the light, and only shade when required. This method of raising gums will suit the farmer, but not the forester, nor the man who wishes to send the plants a distance. The seed will cost from 1s. 6d. to 2s. 6d. per ounce.

Planting.—The pines, cupressus, &c., should be planted out in June or July, and not later than August. In warm districts, where frosts are not

severe, gums (if properly hardened off) can also be planted. They will then be well established before the hot weather sets in. In cool districts, where frosts are severe, gums should not be set out until all danger is past. In lifting the gums for transplanting, great care must be taken not to injure or expose the roots. Allow as much earth as possible to remain on the roots; on gums every root is required. If reduced when transplanted into a new soil and position, the remaining roots will be unable to supply the stem and foliage with sufficient moisture. Hence so many deaths, through the moisture passing away from the stem growth faster than the roots can supply the sap waste. Gums should be planted out in their permanent place when young and small, say from 4 to 12 months old.

Preparing the Ground and Planting.—Take out square holes 12 x 12 or 24 x 24 inches wide, and the same in depth; place the surface soil on one side of the hole, and the sub-soil on the other. For shelter planting on exposed sites the holes should be 8 feet apart, and thin out as the trees grow. When the soil is pulverized, and not too wet or too dry, and the holes free of water, fill in by placing the soil as it was taken out. Should the sub-soil be poor, mix a little surface soil with it. For planting select dull weather. Dry winds are injurious to plants out of the ground; avoid removing them. For planting it is better that two persons should be employed at the work. When root space is made in the centre of the filled-in hole by one man, the other can place the tree in its position from beneath a cover, and steady it while the fine earth is being filled in and pressed gently round.

Sowing Suitable Gums in Belts.—Where this can be done it is the cheapest and best. In rangy country, where there are steep slopes thickly dotted with tree stumps and outcrops of rock, and the surface a tangle of roots, nursery growth must be planted. Where the soil is free from obstacles of this kind, seed planting can be proceeded with. The nature of the surface and sub-soil should be understood, as on this will depend the depth of the ploughing. A good shallow surface must not be buried or mixed out of proportion with a stiff clay sub-soil, that will run together in wet weather, and bake into a hard crust in summer. If the sub-soil is free, open, and porous, plough deep, and work it up to a fine tilth.

Mix the gum seed with dry sandy loam, well sifted, and sow by hand broadcast out of a dish, seed bag, or box. Then pass a light harrow over it. This done, the success of the crop will depend on the season. For this work May, August, and September months are the best. On the climate and district will depend the month selected for the work. As the trees advance in growth thin out, and allow them growing space. A mixed sowing should not be done unless the cultivator understands the nature and habit of the trees he is about to mix. Fence off with a temporary dropper fence. The seed, cultivation, and fence will cost from £2 5s. to £3 5s. per acre, that is, when the planting is done along a permanent boundary fence.

NOTE.—The foregoing article has dealt chiefly with plantations of native trees. In districts where there is no great danger of bush fires the claims of the oak, the elm, and other European trees should be considered. Besides the value of the timber they are of special value on account of the fodder furnished by the leaves and fruit. This matter will shortly be dealt with in the *Journal*. The illustration on the front cover of this issue is that of a 40 year old elm tree at Gisborne.—EDITOR.

THE MAGPIE LARK.

Grallina picata (Latham.)

C. French, F.L.S., F.E.S., Government Entomologist.

This bird, commonly known also as Pe-wit, Mud-lark, Pied Grallina, &c., is a general favourite with bushmen and residents in the city and suburbs. Probably this is one of our commonest and most widely-known birds, being a great destroyer of insect life, all and sundry. Its well-known note "Pee-wee," is always heard in the vicinity of rivers, water-holes, or swamps, where, amongst the trees overhanging the water, it constructs its well-known mud nest and rears its young. It also builds in pine and other trees in the Melbourne Botanic Gardens and reserves, and, as the nest is usually placed at the end of a branch, it is, fortunately, in most instances, out of the reach of boys. The nest is constructed of small pieces of mud, clay, mixed with pieces of dried grass, &c., and measures usually about five to six inches in breadth, and from three to four inches in depth. The eggs, usually four constitute a full set, vary greatly. The usual variety is of a pinkish white ground colour, with brownish spots, often forming a distinct zone at the larger end. In some instances the ground colour is light reddish, with a zone of dark, reddish spots also forming a zone on the larger end. On the Murray, at Benjeroop, near Kerang, I have seen old nests of the Magpie Lark used by the white-rumped wood swallow (*Artamus leucopygialis*), and, according to Mr. A. J. Campbell, the little Cuckoo Shrike (*Graucalus mentalis*) constructs its nest also within that of the Magpie Lark.

The following is Gould's description of the Magpie Lark:—"The sexes are very similar in size, but the female may at all times be distinguished from the male by her white forehead and throat, a fact I determined many times by actual dissection, thus showing the fallacy of the opinion entertained by some naturalists of there being two distinct species.

The male has a line over the eye, a patch on each side of the neck, a longitudinal stripe on the wings, tip of the secondaries, rump, upper tail-coverts, the basal two-thirds and the tips of the tail, undersurface of the shoulder, breast, flanks, abdomen, and under tail-coverts white; the remainder of the plumage black, with a deep bluish tinge on the head, throat, chest, and back, and a green tinge on the primaries and tail; bill yellowish white; irides, straw-yellow; feet, black.

The female differs in having the forehead, lores, and chin white. The young on leaving the nest have the irides black; in other respects, they resemble their parents, but are, of course, far less brilliant in colour."

Mr. A. J. North records the following interesting particulars regarding this useful insectivorous bird:—"Stomachs of these birds, which I have examined, contained chiefly portions of various insects, those being shot near the coast also containing a little sand mixed with a few blades of grass. I have never known it to eat fruit or grain. Pastoralists, sugar-planters, farmers, and orchardists, to whom this bird renders valuable services, should, therefore, assist in affording it absolute protection by preventing thoughtless boys and pot-hunters from trespassing on their lands in search of 'something to kill,' not only in the close season, but all the year round. The ever-trustful and fearless disposition of the bird should in itself be a sufficient claim to the protection it undoubtedly deserves; but,

unfortunately, the easy manner in which it may be approached is too often the cause of many of them falling victims to misplaced confidence in man. It is an extremely sociable species, frequenting the vicinity of houses, and breeding in trees close to the streets in many of the outlying suburbs."

With regard to the courage displayed by this bird, it may be mentioned that, as a rule, very few other birds care to attack it, and even the pugnacious Magpie (Crow Shrike) does not care to interfere with it, the reverse being often the case, as it is quite a common occurrence to see these little birds chasing after a magpie.

The Mud-lark is widely distributed throughout Victoria, and is found also in South Austalia, Queensland, New South Wales, South and Central Australia, Western and North-western Australia, and Tasmania.

THE ELEMENTS OF ANIMAL PHYSIOLOGY.

W. A. Osborne, M.B., D.Sc., Professor of Physiology and Histology, Dean of the Faculty of Agriculture in the University of Melbourne.

(Continued from page 600.)

CHAPTER III.

Hormone and Nerve.

Cells that are specialized to carry out a particular function are as a rule not scattered singly over the body, but grouped into masses; thus the cells that secrete tears are found clustered together into the two organs called lachrymal or tear glands. In such a structure the active cells are held in position by connective tissue, and have arrangements whereby nutriment is brought to them, waste matter removed, and a special outlet or duct system given to their secretion, if they have such. It will be at once obvious that if such cells were to act irregularly and spontaneously, and without any regard to what is going on in the other parts of the body, the latter as a whole would be incapable of carrying out any individual function. We find, on the contrary, that the active cells of the body are under a stern discipline; with specialization of function they have forfeited the power of spontaneous action; they must work at the right times and with the proper intensities; they must start, quicken, slow down, or stop when ordered to do so, and only when so ordered. To understand how this can occur we must first of all assume that in each active cell there is not only the special machinery for carrying out the cell's particular function, but also a substance or mechanism called the RECEPTIVE SUBSTANCE, which can receive a message, and be set into action by the message, and by its action influence the machinery of the cell, either increasing (also starting) or diminishing (also stopping) its action. This receptive substance, although not a part of the special machinery, is still a portion of the cell, and dies when the cell dies. In each cell of voluntary muscle (striped or skeletal muscle) there is only one receptive substance, which in this case can start or augment

the activities of the contractile elements of the muscle cell. When such a muscle cell stops contracting, it does so because its receptive substance is no longer receiving any message. The drug curare (South American arrow poison) has this interesting property, that it temporarily destroys the receptive substances of voluntary muscle all over the body, so that, although urgent messages may be sent, the muscles remain uncontracted and useless. That the contractile part of the muscle is not affected can be shown by *stimulating the curarized muscle with electricity, when a vigorous contraction* can be evoked. Hence it is that in an animal poisoned by this drug all movements, including breathing, cease, and death occurs through asphyxia, though the muscles themselves remain as powerful as ever.

In the cells of involuntary (smooth) muscle and heart muscle, and in the cells of most secreting glands, we find two receptive substances, one which can start or quicken, and the other which can slow down or stop. It must be clearly understood that each receptive substance is fitted for a

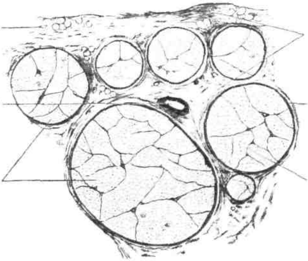


Fig. 20.—Portion of a cross-section of a nerve-trunk magnified twenty times. (After Stöhr.)

particular mechanism; no matter how the receptive substance is set into action, it always acts in the same way on the cell mechanism, either to depress or to augment its activity.

So far as physiologists have been able to discover, there are but two methods by which a receptive substance may be set into action. The first is through the agency of a chemical substance, or HORMONE, which travels in the blood stream, and so reaches eventually the cells to which it is destined; the second method is that of the nervous system.

THE HORMONE.

No more instructive instance of hormone action can be given than that which is responsible for the activities of the pancreas, a gland which pours its digestive secretion into the first part of the intestine, not far from its commencement at the stomach. Now, the contents of the stomach (fourth stomach of ruminants) are acid in reaction, and when this acid mixture leaves the stomach and enters the small intestine, the acid present acts chemically on the wall of the gut and produces a hormone, called SECRETIN. This secretin, as soon as it is formed, is caught up by the blood vessels, and is swept along in the blood stream, and so reaches all

parts of the body, including the pancreas. When the secretin has reached this organ, at once the receptive substances are stimulated, and the gland begins to pour out its special secretion—pancreatic juice—into the gut, and right into the middle of the acid stuff from the stomach. Now, the pancreatic juice is alkaline, for it contains carbonate and bicarbonate of soda, and thus when enough has been poured into the gut it will annul altogether the acidity of the stuff from the stomach. But it was this acid which formed the hormone SECRETIN, and started it on its travels, so that when there is no longer any acid there will no longer be any secretin, and the pancreas will therefore no longer be stimulated. But soon the stomach will send a fresh squirt of its acid contents into the gut, secretin will be formed by the acid, the pancreas will be stimulated, and the pancreatic juice will keep pouring into the gut as long as there is any acid left unneutralized. By this automatic mechanism the pancreas will start acting at the right moment, namely, when food enters the intestine from the stomach; and with the proper intensity, which will depend on the strength of the

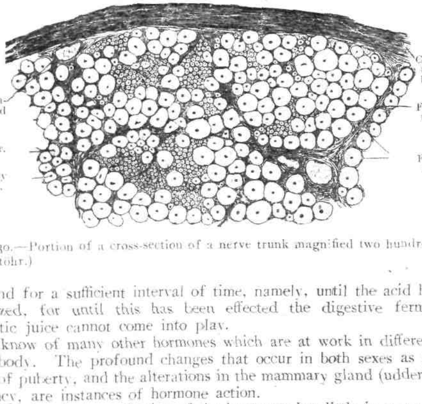


Fig. 30.—Portion of a cross-section of a nerve trunk magnified two hundred times. (After Stöhr.)

acid; and for a sufficient interval of time, namely, until the acid has been neutralized, for until this has been effected the digestive ferments in pancreatic juice cannot come into play.

We know of many other hormones which are at work in different parts of the body. The profound changes that occur in both sexes as a consequence of puberty, and the alterations in the mammary gland (udder) during pregnancy, are instances of hormone action.

Of the chemical constitution of the hormones but little is as yet known, only one true hormone, namely, ADRENALIN, a substance produced in small organs situated near the kidneys, and hence called adrenal, or suprarenal, glands, having been identified by the chemist and prepared in the laboratory. But secretin and the hormones produced in the reproductive organs and in the thyroid gland in the neck, &c., have so far baffled the chemist's researches, chiefly because they are present in the body in such extremely small quantities that to prepare an amount sufficient for an exhaustive analysis is at present impossible. We know this, however, about hormones that they are all comparatively simple bodies; some of them are probably closely allied to certain vegetable alkaloids, and to this similarity in structure we may ascribe the medicinal properties of the alkaloids. For instance, the drug pilocarpine, when it gains admittance to the blood

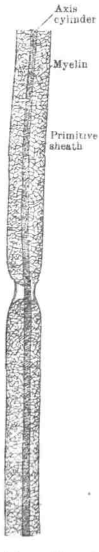


Fig. 31.—Nerve fibre showing axis cylinder and insulating material (medulla or myelin). (After Kölliker.)

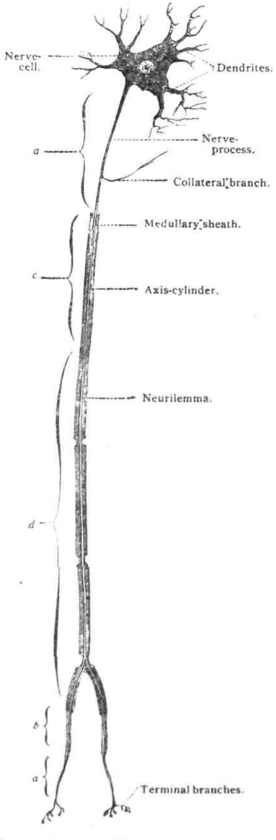
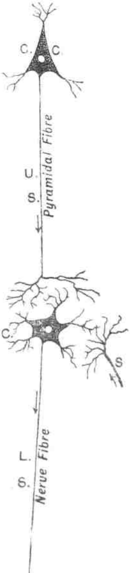


Fig. 32.—Diagram of a neuron. (After Stöhr.)

stream, stimulates through their receptive substances nearly all the secreting glands of the body. The drug atropine paralyzes these same receptive substances, as well as some others. As a rule, the vegetable alkaloids do not act so specifically as the hormones; they act rather on groups of organs than on any one singly, a fact which is probably to be explained by their



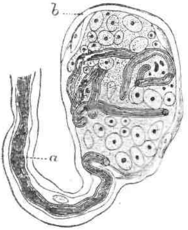


Fig. 34.—Sensory nerve ending in skin.

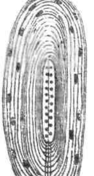


Fig. 33—Diagram showing two neurons S. and U.S. uniting with a third L.S. (After Gowers.)

Fig. 35.—Sensory nerve ending in tongue of duck. (After Klein.)

chemical structure. They may be likened to master keys which can open a number of locks; whereas a hormone may be fitted for one lock only.

The automatic mechanisms which employ hormones, though they may be sure, must certainly be slow. The hormone is formed, then caught up by the blood, and then distributed by means of the blood stream to all parts of the body, including the organ which it is fitted to stimulate. This procedure at its quickest is still slow, compared with some of the reactions

of the body. The burnt child that touches the fire withdraws its hand in a fraction of a second; were the hand to remain until the heat formed a hormone which, when it reached the muscles of the arm, excited them to draw the hand away, there might be very little hand to take care of. Plainly, there is another system of messages in the body, a system which may be likened to the telegraphic, whilst the hormone may be compared with the letter post. It has been named already—the nervous system.

THE NERVOUS SYSTEM.

When we cut across what is popularly termed a nerve, but what the physiologist prefers to call a nerve trunk, and examine it under the microscope, we get appearances such as are given in Figs. 29 and 30. The nerve trunk is in reality composed of several thousand nerve fibres, grouped together into bundles. If we examine one of these fibres we shall find in its centre a core, which is concerned with the conduction of the nerve message, and to which the name AXIS CYLINDER, or AXON, is given. Around it we find an insulating jacket, composed of a phosphorized fat, the MEDULLA, or MYELIN, which is, however, not complete, but broken at intervals, as shown in Fig. 31, so that nutriment can get into the axis cylinder.

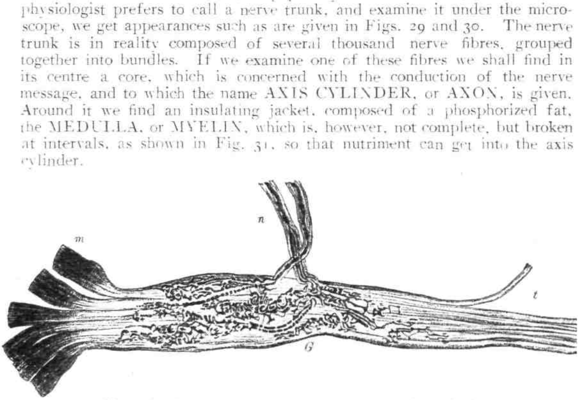


Fig. 36.—Sensory nerve ending in tendon. (After Ciaccio.)

If we choose any nerve fibre anywhere in the body, and follow it along its course, we shall always come in one direction or the other to a nerve cell. In fact, a nerve fibre, or, more correctly stated, the acting part of a nerve fibre, the axis cylinder or axon, is a prolongation from a nerve cell, and is therefore part of that cell. Nerve cells may possess few or many prolongations, but generally one can be picked out which is a typical axon or axis cylinder. Most axons acquire the insulating jacket, or medulla described, and are therefore termed medullated nerve fibres; some, however, do not, and are termed non-medullated nerve fibres. Every nerve fibre contains an axon, and every axon is a process from a nerve cell. To this whole system—the nerve cell, with all its prolongations, axon included—the name NEURON has been given. It is important to have a clear idea as to the neuron, for out of neurons the entire nervous system is built. The nerve trunk cut across, and shown in Fig. 29, contains several thousand axons, each of which is part of a nerve cell. Where the nerve cell is situated will depend on the specific use to which its axon is put.

Now, the function of a nerve fibre, or axon, is to transmit a message, called a NERVE IMPULSE. What the impulse exactly is still baffles

all attempts of physiologists to discover. We know that it is not something material which is driven or sucked along; nor is it a chemical change which runs along the axon as fire will run along a train of gunpowder; nor is it an electric current such as runs in telegraph and telephone wires, for its speed is too slow for this—the electric current travels at the rate of some hundred thousand miles per second, whereas the nerve impulse, if given an axon long enough, could never cover more than 65 yards in the same time. All that we can state is that the nerve impulse is a physical change, which runs along the axon without leaving it permanently altered by being so used. A wave travelling along water, a sound travelling through air, a twist running through a long thin strand of jelly, are instances of physical changes, but they are not quite the same as a nerve impulse. That the nerve impulse is not chemical is shown by the absence of any rise in temperature, and by the fact that no waste products can be detected. Moreover, the axon cannot be fatigued; a hundred thousand impulses may pass through an axon in quick succession, and the last be transmitted as quickly and powerfully as the first. The only detectable change in the nerve fibre which accompanies the passage of an impulse is a change in the electrical state of the nerve as tested by delicate instruments. Most probably the impulse is a change in the arrangement of the particles inside the axon, which we know are charged with electricity; when the impulse has passed these swing back into their old positions.

An impulse is very readily started in a nerve fibre; most things which destroy its delicate structure will bring an impulse into being—for instance, crushing, burning, or irritation with corrosive chemical bodies. These may be applied, however, so weak as not to injure the substance, but still capable of starting impulses; thus, tapping a nerve lightly will send impulses along it; electric shocks are very efficient starters also. Now, in all these cases, whenever an impulse is started artificially somewhere in the course of an axon, the impulse travels always up and down, and passes into every branch of the nerve cell. We may here lay down the law that if an impulse be started in any part of a neuron it will travel through every part of that neuron. Now, in nature it never happens (except in accidents) that a nerve impulse starts in the middle of an axon; provision is always made that it shall travel from one end of a neuron to the other end.

Another fact about nerve fibres follows at once from what has been stated in a former chapter. If a nerve fibre be cut, then that portion still in contact with the nerve cell lives, the portion cut off from the nerve cell dies. This fact gives the experimenter a valuable method for tracing the destination of any particular group of fibres.

The nervous system is divided into two parts—the CENTRAL NERVOUS SYSTEM, composed of brain and spinal cord; and, secondly, the parts that lie outside the central nervous system, and to which the name PERIPHERAL NERVOUS SYSTEM has been given. In the peripheral nervous system we meet with four types of neurons—one type which carries impulses *into* the central nervous system (or C.N.S., as we may briefly call it), the other three types being concerned with the passages of impulses *out* of the C.N.S. We shall deal with these in sequence.

ENTRANT or AFFERENT Neurons—that is, neurons which carry impulses into the C.N.S.—are all of the type indicated by A in Fig. 39. The nerve cell is small, and is to be found in a ganglion placed near the C.N.S., but not in it. We find such ganglia near the spinal cord, and called dorsal root ganglia, to be described in a later chapter. The connexion of

the axon with its cell by a T-piece is fairly characteristic of this type. If we trace such an axon towards the periphery—that is, away from the C.N.S.—we shall find that it comes to an end in a special organ specially made for the starting of impulses. Let it be at once understood that all these afferent or sensory nerves are the same in nature. They differ, however, in their connexions with the C.N.S., and in the nature of the end-organ or sensory end-organ, which starts impulses in them. The impulses themselves do not differ one from another; what gives them their special significance is their place of origin and their destination in the spinal cord and brain. Each nerve is a mere conductor of nerve impulses, and impulses only differ from each other in intensity.

A sensory end-organ we may look upon as a special apparatus, which will start an impulse in the nerve to which it is attached when it is disturbed

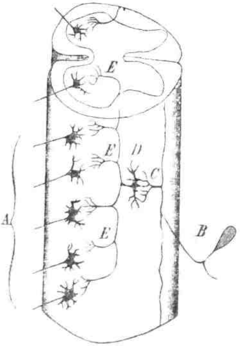


Fig. 37.—Diagram showing how an impulse entering the central nervous system by a sensory neuron DE may pass to the motor neurons A by means of the linking neuron DE. (After Kolliker and v. Lenhossek.)

in a particular manner; we generally find, too, that the end organ is shielded from disturbances which it is not asked to record. Thus we find in the *skin* of all the higher animals certain end-organs which start impulses when they are warmed. The animal will thus feel the sensation of warmth, and will ascribe it to the part of the skin warmed; but if the nerves coming from these same end-organs were stimulated with electricity, and not heat, the animal would still have the sensation of warmth, and would locate the feeling at the spot stimulated. It is the point of origin and the distribution in the C.N.S., and not the nature of the impulse which determines the nature of the sensation.

A tabulated list of the sensory end-organs may be given as follows:—

(*a*) Confined to the skin, starting impulses—

1. On application of pressure; or at the base of a hair when the hair is moved, giving rise to touch.
2. When warmed, giving rise to sensation of warmth.
3. When cooled, giving rise to sensation of cold.

(*b*) In muscles and tendons (sinews) and ligaments of joints, starting impulses when these are stretched, and therefore informing the C.N.S. as to their condition.

(*c*) In the eye, shielded from heat, and to some extent from mechanical injury, and starting impulses when acted upon by light (or darkness after light).

(*d*) In the ear, starting impulses when acted upon by waves of sound.

(*e*) In the semi-circular canals of the ear (the most important sense organs animals possess). Here impulses are produced by the way in which water lies (or is driven by movements of the head), in a system of arched tubes that run in three directions, and in this way tell the animal the position of its head, and in what direction its head is being moved, and thus allow the body to be kept balanced.

(*f*) In the nose, starting impulses when acted upon by certain gases, giving sense of smell.

(*g*) In the mouth, starting impulses when acted upon by certain soluble chemical bodies, giving sense of taste.

(*h*) Widely distributed over the body, and starting impulses when anything threatens to destroy the structure of adjacent living tissue; hence acting as danger signals, and giving the animal sensation of pain.

(*i*) There are other nerve endings in the body which can start impulses under special conditions—for instance, those telling the animal that its stomach is empty, or its bladder full, &c., &c. These, however, are few in number, and highly localized.

In these end-organs impulses can be started, and in most of them impulses are constantly being started, which, travelling along their respective axons, enter the central nervous system. The course of these impulses through the C.N.S. this is hardly the proper place to describe. It will be sufficient to say that each afferent neuron makes connexion in the C.N.S. with a number of other neurons, and each of these latter with a number of others, so that the impulse after it arrives is carried up and down, and is widely distributed through the C.N.S. The passage of an impulse from one neuron to another takes place at a region called a SYNAPSE, where branches from both neurons interlace. Of the importance of the synapse something will be said later, but one of its peculiarities must be mentioned here, and that is its valve action, which allows impulses to pass in one direction only. Hence it is that no impulses ever leave the C.N.S. by any of the afferent nerves, and, conversely, none can get in by any other channel. The nerve impulses that enter the C.N.S. pass through it in various directions, such directions being determined by the past history of the race (reflex action and instinct), and the past history of the individual (memory and intelligence). They do not lose in intensity by being thus scattered; in fact, they may gain enormously in power, and may last for much greater intervals of time, a change which is effected by the nerve cells of the neurons through which they pass. The nerve cell of the afferent neuron does not influence the impulse; it has, in fact, but few duties to perform, chief among which is maintaining the integrity of the whole neuron; but the cells of the C.N.S. not only preserve the vitality of their axons and other prolongations, but also do actual work by augmenting and prolonging the impulses which pass through them. We must picture the C.N.S. as constantly receiving impulses from its afferent neurons. These impulses

pass through and through the dense network of neurons of which the C.N.S. is composed, blend with each other into special combinations, and finally leave the C.N.S. by exit or efferent paths, of which there are two types—

1. Motor to Voluntary Muscle (Fig. 39B).—The nerve cell is found in the C.N.S., and from it an axon passes uninterruptedly to a muscle; the axon divides up in the muscle substance, and each branch ends by passing into the receptive substance of a muscle fibre.
2. Autonomic Paths. — Each autonomic path is peculiar in that the efferent nerve fibre does not pass uninterruptedly to the organ to be innervated, but ends by branching round a nerve cell which is situated in a nerve ganglion (Fig. 39C). To this nerve fibre the name PRE-GANGLIONIC is given. (In the diagram, for the sake of clearness, the pre-ganglionic fibre is made to branch round one cell only; in reality it branches round several, and so the impulses multiply.) From the nerve cell in the ganglion a nerve fibre (axon) called POST-GANGLIONIC passes into the receptive substance of the cell innervated (Fig. 39D).

It is interesting to note that, whilst the first type of efferent nerves, viz., the motor, passes only to one kind of tissue, namely, voluntary muscle, in the autonomic system, we find that the post-ganglionic fibres can pass to two different types of tissue—

(*a*) involuntary (smooth) muscle found in the walls of the stomach, bladder, gut, uterus, and the various ducts of the body; also the muscles in the walls of arteries and veins and the small muscles attached to roots of hairs (and feathers). Heart muscle must also be included here.

(*b*) Secreting glands, such as the glands of the stomach and intestine, the salivary glands, tear glands, sweat glands, &c.

One very important character about these organs innervated by the autonomic system is that they are not under the influence of the will. An animal can move its voluntary muscles at will, but over heart and artery, stomach, bowel, gland, &c., the will has no power; these organs, innervated by the autonomic system, receive their nerve impulses, therefore, in a purely *automatic* manner, and the number, duration, and intensity of the impulses they receive from the C.N.S. will depend on the nature of the impulses that have gone *into* the C.N.S.

Another striking character of the autonomic system is that whilst it may be divided anatomically into three parts—namely, that coming from the brain (cranial autonomic), that from the spinal cord in the thorax (thoracic autonomic), and that from the lowest portion of the spinal cord (sacral autonomic)—it may physiologically be divided into two parts only, namely, the thoracic autonomic on the one hand, and the cranial and sacral on the other. The thoracic autonomic system has long been known under the name of the *symptathetic system*, from a mistaken idea as to its nature.

We frequently find that an organ is supplied with two sets of autonomic nerves with different functions, one of these sets always being thoracic autonomic, or sympathetic, the other being either cranial or sacral. For instance, the movements of the stomach (stomachs of ruminants) and small intestine are depressed by thoracic autonomics, but excited by cranial autonomic (vagus nerve). The movements of the large intestine are depressed

by thoracic autonomic impulses, but excited by sacral. The heart is slowed down in speed by cranial antonomics (vagus fibres), but excited by thoracic. The salivary glands secrete a copious watery saliva when the cranial autonomics are stimulated, but a scanty and thick saliva when the thoracics are stimulated. The iris dilates under the influence of thoracic, but constricts under the influence of cranial. The arteries in the reproductive organs are dilated by sacral, the arteries of the salivary glands are dilated by cranial, but all arteries of the body except those in lung and brain, which have no nerve supply, are constricted by thoracic autonomic impulses.

Mention may be made here of the fact that the nerve trunks which we find in the animal body generally contain representatives of more than one of the four types of neurons described. Thus, the sciatic nerve contains afferent, motor, and post-ganglionic axons; the vagus nerve contains afferent, motor, and pre-ganglionic axons; nerves connected with muscles always contain afferent as well as motor fibres.

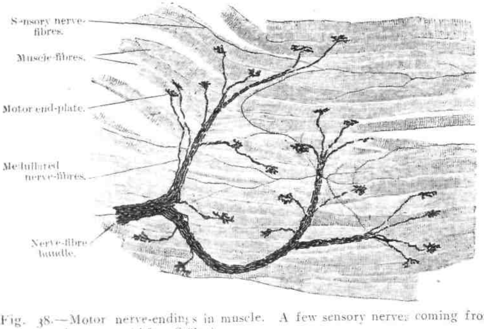


Fig. 38.—Motor nerve-endings in muscle. A few sensory nerves coming from the muscle are also seen. (After Stöhr.)

Reviewing the whole nervous system, we find, first of all, that there are organs in which impulses can be started, namely, sensory end-organs. The impulses thus started travel by means of afferent nerves to the central nervous system. After traversing the C.N.S., and being modified as regards power and duration, they pass out into two sets of efferent paths, one going to voluntary muscle, the other set going to organs over which the will has no control. The central nervous system, though it can modify impulses, apparently cannot create them. If no impulses pass in none will pass out. Even if a limited number of entrant or afferent paths be blocked, some of the exit or efferent cannot be used. If, for instance, the sensory nerves of a limb be cut, the limb cannot be moved by any effort of will—it is as completely paralyzed as if the motor nerves were cut. The same may be seen on a reduced scale when one's fingers are very cold, and in consequence clumsiness of their action ensues. The cold paralyzes the sensory end organs of the skin, tendons, and joints of the fingers, but does not affect the muscles of the forearm which move the fingers, and yet these muscles are partially paralyzed.

This conception of the dependence of outlet impulses on inlet should always be borne in mind. If, for instance, we find that an organ is receiving an unusual rush of efferent impulses, there is generally some alteration in the sensory impulses to account for it. The muscles of the dog's hind leg that are thrown into action when the animal scratches, receive their impulses from the spinal cord, but the original impulse was started at the skin by something tickling the skin. It is interesting to note that the action of scratching, like many other actions, needs only a portion of the C.N.S. to carry it out. A dog which has its spinal cord cut across in the neck will scratch with its hind foot when a spot on the back is tickled, though it feels nothing with its brain, and is apparently unaware of the whole proceeding. The leg of a man whose back is broken across will kick out when the sole of the foot is tickled, and yet the man be utterly unconscious of the action, and unable to move his legs by any effort of will.

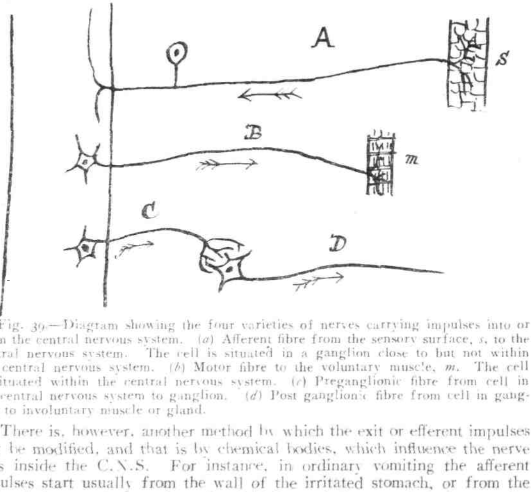


Fig. 39.—Diagram showing the four varieties of nerves carrying impulses into or from the central nervous system. (*a*) Afferent fibre from the sensory surface, *s*, to the central nervous system. The cell is situated in a ganglion close to but not within the central nervous system. (*b*) Motor fibre to the voluntary muscle, *m*. The cell is situated within the central nervous system. (*c*) Preganglionic fibre from cell in the central nervous system to ganglion. (*d*) Post ganglionic fibre from cell in ganglion to involuntary muscle or gland.

There is, however, another method by which the exit or efferent impulses may be modified, and that is by chemical bodies, which influence the nerve cells inside the C.N.S. For instance, in ordinary vomiting the afferent impulses start usually from the wall of the irritated stomach, or from the back of the mouth, pass into the C.N.S., and then out into the muscles concerned in the act of vomiting. In those animals that vomit readily this act can be produced by injecting the drug apomorphine, which operates on the nerve cells concerned with the motor impulses of vomiting, and if it does not start impulses in them, at any rate makes the cells irritable, and responsive to afferent impulses which normally would be far too weak to have any effect. These nerve cells particularly concerned with vomiting constitute what is termed the NERVE CENTRE for vomiting. There are similar centres for breathing, swallowing, &c., which will be dealt with later.

We can now understand why the child draws its burnt hand away from the fire. Impulses have started in the burnt finger, which will be classified by the child as pain, they reach the central nervous system, pass through it, and pass out into the motor nerves which run to the muscles of the affected limb, causing them to contract, and the hand, therefore, to be quickly withdrawn. If it be asked why do the impulses go to the right muscles, and not to the other parts of the body, we may answer that the child was born with certain paths laid down in its central nervous system, along which impulses will pass in preference to all others, and that this is one of them.

ARSENITE OF LEAD SPRAY FOR CODLIN MOTH.

E. E. Pescott, Inspector, Vegetation Diseases Acts, Bendigo.

Owing to the prevalence of codlin moth, it is now a recognised fact among orchardists that the only adequate method of coping with this pest is to spray the trees and fruit with some arsenical solution, whereby the young grub may be poisoned before entering the fruit. Paris green was amongst the first sprays used for this purpose. This was afterwards superseded by arsenite of lime. Latterly, however, in the Bendigo district, as well as in other places, the arsenite of lead spray has become very popular, and has been used with excellent results. The majority of growers using this spray now consider it superior in every way to arsenite of lime or to Paris green. The formula is as follows:—1 lb. white arsenic, 2 lbs. carbonate of soda crystals, 7 lbs. acetate of lead, and 360 gallons of water.

To make the stock solution, the arsenic and soda should be boiled together for from 20 to 30 minutes, in half a gallon of water. The acetate of lead should be separately dissolved in one gallon of warm water. When cold, the arsenic-soda solution should be gradually stirred into the lead acetate solution till both are thoroughly mixed. If mixed when warm the union of these two solutions results in extreme effervescence, and great care should be taken that the froth does not run over the vessels used. When cooled, the mixture becomes liquid again, and may be stored away for use. There will be twelve pints of the stock solution, and if this be placed in twelve pint bottles, one bottle can be used to every 30 gallons of water. The stock solution will keep indefinitely.

This spraying solution is considered superior to arsenite of lime for many reasons. Provided the water be strained, the mixture runs freely through the pump, and the whole of the contents of the cask may be sprayed without once choking or clogging the nozzle. This point alone should make the spray a popular one. In the arsenite of lime spray trouble is often experienced in obtaining freshly-burnt lime, and the resultant mixture is not as perfect nor as effe .ive as it might be. The absence of good lime, too, might have a caustic effect on the foliage. This spray adheres better to the foliage and fruit than other sprays, and consequently less material may be used for each tree. Again, the trees are not rendered unsightly, as with the lime spray, and the fruit does not require cleaning after picking. In spraying with arsenite of lead, the spray should be misted finely on to the trees; the liquid should not run down the limbs and trunk. It is a mistaken idea that the running spray will kill any grubs that may be hiding in the crevices of the tree. The

arsenite of lead spray does not kill by contact; its effect is to poison the grub that eats it. This spray also keeps down the pear-slug pest.

In the season of 1904-5 Inspectors Cock and Pilloud conducted a small experiment at Dunolly with the three arsenical sprays, viz., Paris green, arsenite of lime, and arsenite of lead. Three rows of trees were selected, and a row of twelve trees was sprayed with each spray. The result, which was as follows, speaks for itself:—Paris green, 75 per cent; arsenite of lime, 82 per cent.; arsenite of lead, 90 per cent. of perfectly clean fruit.

Some growers, in districts where Black Spot is prevalent, add 1 lb. of bluestone to every 50 gallons of this spray. Messrs J. Clarkson, of Lockwood, and J. Hargreaves, of Emu Creek, used this combination last season with excellent results. The latter grower estimates that, by the use of the arsenite of lead spray, he last season obtained 98 per cent. of fruit, perfectly free from Codlin Moth. Mr. Hargreaves sprayed fourteen times, and many of his apple trees, loaded with fruit, were absolutely without an infected apple. Messrs T. Somerville (Strathfieldsaye), H. Keck (Bendigo), H. Windsor (Marong), H. Winkelmann (Campbell's Creek), and J. Douglas, H. McLean, and J. Pellas, of Harcourt, as well as many others, all used this spray last season with excellent results. And, as an instance of its continued popularity, a large majority of growers in the extensive apple and pear growing district of Harcourt has this season ordered chemicals for spraying exclusively with this spray.

In conclusion, it may be well to repeat the necessary additional action to be taken in order to keep the orchard free from this pest: Scrape off all loose bark. Fill and plug all holes and crevices in trees. Leave no cracks or broken ends of limbs. Clear away all weeds and growth around trees. Have the bandages examined thoroughly and regularly. Keep fruit houses frequently cleaned and examined for grubs. Allow no second-hand cases in the orchard. Destroy all bags and packages likely to have come in contact with infected fruit. Gather and destroy all fallen fruit. Growers are also urged to accurately measure for themselves their pump casks or barrels, as the reputed measurement is very often the result of guesswork, and hence inaccurate. The result is that the spray is either ineffective, or the tree is burned by the mixture being too strong.

The arsenite of lead spray is not at all an expensive one. With the cost of chemicals at the present ruling rate, it works out at about 6½d. per acre for each spraying, or at a cost of 4s. 4d. per acre for eight sprayings, exclusive of the cost of labour.

DAIRY PRODUCE COMPETITIONS.

The Hon. the Minister of Agriculture has provided £150 towards prizes and medals to be awarded at the Dairy Produce Championship Competitions in connexion with the Exhibition of Australian Manufactures and Products, to be held at the Exhibition Building, Melbourne, during January and February, 1907. Various dairy produce firms, companies, and butter factories have also made liberal contributions towards the prize fund, so that the Committee of Management has been enabled to offer five gold medals, thirty-two A.N.A. exhibition certificates, and £254 in cash prizes.

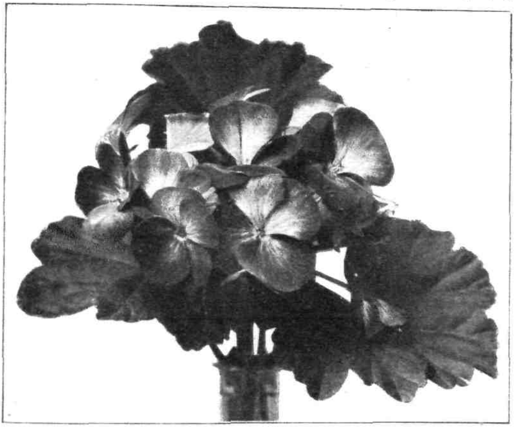
Entries for the various classes must be lodged on or before the 14th December, with the Secretary for Agriculture, from whom full particulars may be obtained.

GARDEN NOTES.

J. Cronin, Inspector, Vegetation Diseases Acts.

The Pelargonium.

Pelargonium is a family of plants consisting of annual, biennial, herbaceous, and shrubby species, which, with the exception of a few unimportant kinds, are natives of Cape of Good Hope. The original species are rarely cultivated now, except in botanical collections, although several are beautiful in their foliage and flowers. What are known as florists' pelargoniums are hybrids from various species, but, except the zonals, derived from *P. zonale*, a species introduced into England in 1710, and



"ADOLPHE BRISSON"—ZONAL TYPE.

the ivy-leaved, from *P. lateripes*, introduced in 1787, the parentage of the present-day kinds is uncertain. The types of cultivated pelargoniums are: Zonal, commonly but wrongly called geraniums show; regal or decorative; fancy; and ivy-leaved or climbing varieties. There are also hybrids from various species not generally grown, and variegated leaved zonals.

The popularity of pelargoniums is not as great as twenty years ago, when the various horticultural societies catered specially for growers of these plants, but a distinct revival has occurred in the last few years, especially in the zonal class. A few kinds of this class were always popular on account of their bright colouring, easy culture, and hardiness, and of late many fine new kinds, that are a marked advance in size of flower and

truss, and of a much greater range of colour, have been raised and distributed. In a climate free from severe frosts they grow into large bushes quickly, and are scarcely ever devoid of bright effective flowers. They are also specially suited for pot culture, and will flower freely during the greater part of the year. The variegated varieties are more suitable for pot plants than the open garden. The show and decorative varieties are the most popular as pot plants, and some beautiful specimens are occasionally seen at horticultural exhibitions. They are also worthy of much more extended culture in the open borders, where, when properly treated, they rival azaleas and other popular plants in their wealth of bloom. The show varieties are hardier and neater in habit of growth than the regals, and, though smaller in the trusses and plainer in type of flower, are more floriferous. The regals at their best are splendid flowering plants, but are not often seen to advantage in the open garden. The trusses and individual flowers are larger than in the show kinds, and the petals are frilled and of much greater substance. Fancy, or "ladies'," pelargoniums are a smaller growing type, producing neat trusses of bloom. They were very popular at one time, but are now rarely seen, except in nursery collections. A much more generally grown class are the ivy-leaved or climbing varieties, some of which are among the most effective and rapid growing of climbing plants. These are specially useful for covering unsightly places in the garden, but one drawback to their general value is their liability to become a harbor for snails.

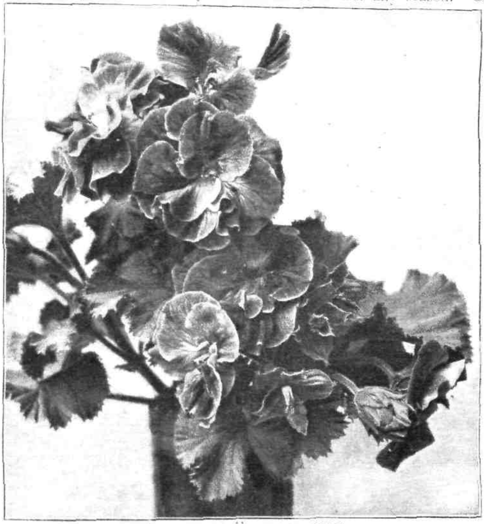
CULTURE.

Pelargoniums of all classes require sweet, well-drained soil, whether cultivated in pots, boxes, or open ground. They will endure a deal of drought without suffering greatly, but will not thrive if planted in sour, wet soil. The most suitable soil is a fibrous loam, with sharp sand added for pot culture. Well-rotted horse or cow manure should be added to potting soil, but except in the poorest of soils no manure is necessary for open ground culture, especially in the case of the regal varieties. Fine specimens are occasionally to be seen growing in poor sandy soil, flowering splendidly in season; but when heavily manured, and liberally watered in summer, gross growth is produced at the expense of bloom. Plants may be set out from pots at any time in the growing season, early autumn being the most suitable. This is also the best time to transfer plants to different stations in the open ground.

Pinching the point out of the leading shoots is all the pruning needed to shape young plants, causing them to break into lateral growth. Plants may be retarded in their time of flowering, and also furnished into well-shaped specimens if thin and leggy, by pinching the points of the growing shoots in spring. After the flowering period, pot-grown plants should be placed in full sunlight, and water used sparingly, to ripen the growths. These growths should be thinned out and pruned back, leaving about 2 or 3 inches of the shoot. To make nice specimens for the following season, shoots of equal size and at equal angles from the main stem should be retained, if possible. In the open ground the same treatment should be followed as far as practicable. In the case of zonals very little pruning is needed. An occasional thinning when the plants are becoming crowded, and pinching the top of an extra vigorous shoot, will keep the plant in shape.

Pelargoniums are propagated from cuttings of the ripened shoots, inserted at the pruning time. The cuttings should be about 3 or 4 inches in

length, the bottom leaves removed, and the shoot cut cleanly across with a sharp knife close below a joint. They may be inserted in pots, boxes, or the open ground. A sweet soil without any fermenting material is most suitable; sand placed at the base of the cutting improves the ordinary chances of rooting. No manure whatever should be allowed near the base of cuttings of any plants. The cuttings when rooted may be potted and grown on for a time, or may be placed at once in the position selected for them. Cuttings of zonals may be inserted at almost any season. Gross



"PERSIMMON"—REGAL TYPE.

sappy shoots should not be selected for cuttings. New varieties are raised from seed, which is easily saved, and plants can be raised without much trouble. If good varieties are inter-crossed fair results may be expected.

VARIETIES.

The following are desirable varieties:—

Regals.—Her Majesty, Madame Thibaut, Duchess of Bedford, Empress Frederick, Edward Perkins, Captain Raikes, Persimmon, Queen Victoria, Dorothy, St. Visto, Cremorne, Le Grand, Emperor of Russia, Gold Mine.

Show.—Claribel, Isabel, Embassy, Argus, Lady of the Lake, Mabel, Conductor, Diplomatist, Maritana.

Zonal.—Single: Adolphe Brisson, Conan Doyle, M. H. Tilmant, Maud of Wales, Snowdrift, Mary Felton, Charles Recolin, Barbara Hope,

Dryden, Dr. Nansen, Miss Fenn, Louis, Chaucer, Rev. F. Atkinson. Double and semi-double: Australian Gold, Charles Gounod, Fraicheur, Golden Gate, Huber Charron, F. V. Raspail (improved), Hartwig Buchner, Kleber.

Ivy-leaved.—Souvenir de Charles Turner, Beauty of Jersey, Abel Carriere, Ryecroft Surprise, Jeanne d'Arc, Future Fame, l'Elegante, Multiflora.

Flower Garden.

General gardening work of importance during this month is the continuance of surface cultivation, watering when necessary, and staking and training growing plants. Where water is needed it should be applied thoroughly, a light surface sprinkling being of little service, and often decidedly harmful, as roots are encouraged too near the surface, where they will be injured by cultivation. A good soaking is necessary, and the surface should be broken finely again as it is drying. Plants that specially need water during dry weather are those newly planted, and surface rooting kinds, such as ericas and azaleas. When free growth is being made the plants should not be allowed to suffer from lack of water, but those with matured foliage rarely require it at this season, except under specially severe conditions. Plants such as violets, primroses, and other winter and spring flowering species, require no water, being in a state of comparative rest at this time.

After the spring flowering is over, roses should be allowed to rest—*i.e.*, should not be forced into growth by the free use of water. Ordinary surface cultivation will suffice in the case of established plants, or in very dry situations a mulch of stable manure. Weakly growths may be cut away, and ample room should be allowed for the development of the remaining shoots.

Dahlias should be planted this month. If beds have been prepared for them, the plants may be set out in late districts early in the month. The end of the month is preferable for the metropolitan district, and early districts where there is no danger of early frost. Divisions of the tubers may be set out a week or two later than young green plants from pots, and then flower simultaneously with them.

Care should be taken not to break the "ball" of soil when planting green plants from pots, and some shelter should be provided for a few days should the weather be hot. A pot inverted over the plant, or a rough shading of bracken or such material, is sufficient. Plants in pots should be thoroughly watered before being "knocked" from the pots, and the young plants carefully watered, if need arises, for a few days.

Chrysanthemums should be tied to stakes as growth develops. All lateral growths, where large blooms are desired, should be removed as they appear. Very little water is necessary where the plants are growing fairly. Steady growth should be aimed at.

Kitchen Garden.

The hoe or other cultivator should be kept going between rows of growing crops. Water should be applied during hot, dry weather before the young plants actually suffer. Water should not be applied overhead on hot days. Tomatoes should be tied to stakes or trellis as growth develops, and lateral growths removed. A few of the strong growing varieties, such

as Ponderosa, set their fruit better when trained on a trellis at sharp angles from the upright; tied to stakes, or trained perpendicularly, they grow too vigorously to fruit well. Shy bearers are also stopped occasionally at a joint above the one carrying the flowers, the check causing the fruit to set. Should the larvæ of the tomato moth attack the plants, they should be sprayed with a solution of Paris green, at the rate of 1 ounce to 12 gallons water; milk of 1 pound fresh lime should be added, and the mixture kept thoroughly agitated while being applied.

Seeds may be sown for a succession of various saladings, peas, beans, &c. Plantings may be made from former sowings, choosing a dull day, if possible, for the purpose.

THE RASPBERRY.

James Lang, Harcourt.

The raspberry is essentially a cool climate fruit, and will only succeed in those districts which have a considerable elevation and a moist climate. The Dandenong Ranges and the ranges around Kinglake is the ideal home of the raspberry. It succeeds best on a deep loamy soil, and will also do well on alluvial soil of good depth; soil of a dry, sandy nature is the least desirable. Raspberries bring in a small return the first year of planting, and are therefore very suitable for small growers, who must have a return for the labour and capital expended as soon as possible. When choosing a situation for a raspberry plantation, see that it is sheltered as much as possible from hot winds, which sometimes cause great loss to the grower in a hot dry spring.

PREPARING THE LAND.

In preparing land for planting, it should be deeply ploughed to a depth of at least 8 inches, and allowed to lie fallow till the autumn. During the summer the ground should be stirred occasionally with the scarifier to destroy the weeds as they appear, and about the beginning of April the ground should be again ploughed and harrowed down level; it is then fit for planting.

PLANTING.

The plants should be put out in rows 6 feet apart, and 4 feet apart in the rows; this gives plenty of room to work the ground with the horse-hoe. The young plants are usually suckers obtained from an old plantation. Be careful to select plants from a healthy root stock, as plantations which have been growing for a number of years are sometimes diseased, and young plants from such a source rarely do well, as it takes them two or three years to get into a healthy state again. Three suckers should be planted together about 6 inches apart; this forms what is called the stool. If the plants are put in early during May or June a nice little crop will be obtained the first year.

CULTIVATION.

This will mainly consist of keeping the ground clean with the horse-hoe, and thinning out the young suckers in the spring. The plants generally produce a quantity of suckers that are not required, and if these are left they soon exhaust the soil, robbing the plant of nourishment that should go

towards maturing the fruit. They should, therefore, be thinned out, leaving just sufficient to form canes for the next year's crop of fruit. When the fruit is all gathered, the old canes should be at once cut out; this leaves more room for the young canes to develop.

About the month of June the ground should be ploughed; throw the furrow up to the plants, leaving a furrow down the middle of the row. This drains surplus water off during the winter. About October the ground should be ploughed the reverse way from the plants towards the centre; this leaves a narrow strip which should be levelled into the furrow with a heavy hoe. In a week or two run the horse-hoe up and down the rows, so as to leave the ground perfectly level and in a good state of tilth.

Pruning, Manures, &c.

During the winter all surplus suckers should be removed, leaving four strong fruiting canes for the second year's crop. These should be topped to a height of about 5 feet. The following and each subsequent year, six canes may be left for fruit bearing, all others being removed. Stakes should be put in at each stool in order that the canes may be tied up.

The gathering of the fruit extends over several weeks, as the fruit ripens very irregularly. It is, therefore, necessary to gather the ripe berries two or three times a week.

Manure should be supplied to the plants after they have been bearing two or three years. Where farmyard manure is not available, one of the many orchard manures on the market should be used at the rate of 4 cwt. per acre.

The varieties mostly grown are Northumberland Fillbasket, Fastolf, Red Antwerp, Semper Fidelis.

THE PROCLAIMED PLANTS OF VICTORIA.

(*Continued from page* 688.)

Alfred J. Ewart, D.Sc., Ph.D., F.L.S., Government Botanist; and J. R. Tovey, Herbarium Assistant.

Nut Grass.

Cyperus rotundus, Linne. (*Cyperaceæ.*)

Stem ½ to 1½ ft. high, from a short, sometimes creeping, rhizome, the fibrous roots occasionally forming small tubers. Leaves flaccid, much shorter than the stems. Umbel-rays not numerous, the outer leafy bracts seldom so long as the longest rays. Spikelets, very narrow, sharply pointed, varying from 1 to 2½ lines in length, 3 to 8 together, in short spikes at the ends of the rays. Glumes numerous, overlapping, a narrow egg-shape, scarcely pointed, red-brown, with a green keel and light-coloured edge. Style long, 3-cleft. Nut much shorter than the glume. Widely diffused over the tropical and temperate regions of the New and the Old World. It is a troublesome pest in farms and gardens. Continued hoeing in cultivated ground would help to suppress it, but the rhizomes and tubers should be dug out, dried, and burnt. Proclaimed under the Thistle Act for the whole State.—September, 1892.

(*To be continued.*)

PLATE 7

NUT GRASS

ARTIFICIAL FERTILIZERS AND THEIR USE IN MARKET GARDENS.

F. E. Lee, Agricultural Superintendent.

Some months ago inquiries were instituted among the market gardeners in the East, North, and South Brighton, Cheltenham, Caulfield, Oakleigh, Clayton, and Spring Vale districts, with a view to ascertaining the practice generally pursued in the use of artificial fertilizers for the production of vegetables. One hundred market gardeners were visited, viz.:—

East Brighton	.. 36	Caulfield ...	... 4
North Brighton	... 10	Oakleigh ...	... 1
South Brighton	... 30	Clayton ...	... 9
Cheltenham	... 9	Spring Vale	... 1

The following set of questions was asked in each case:—

1. What amount of stable manure do you use?
2. Do you use it on all crops?
3. Do you use any artificial manure in conjunction with the stable refuse, and, if so, what kind, how much per acre, and on what crops?
4. Do you use any different method of fertilization for special crops?
5. Do you use any artificial manures for top dressing, and, if so, what kind, how much per acre, and on what crops?
6. Is the garden naturally or artificially drained?
7. What is the nature of the soil?

These questions were put to elicit definite information, and it is on the general answers to these queries that this report is based.

THE OBJECT OF THE INQUIRY.

The objective of the inquiry was to discover if it would not be possible to so amend the present use of artificial manures that the same—or, possibly, better—results might be obtained at a less cost. It is a common error to think that, because moderate amounts of artificial manures produce increased returns, that four times the amount should increase the returns fourfold, or nearly so. That such is not the case is not difficult to prove. For example, a plant requires some ten or twelve different substances for its successful growth. Out of these there are, as a rule, only four which require renewal by artificial means, viz., nitrogen, phosphoric acid, potash, and lime.

A plant, however, has a certain amount of selective power, and does not draw upon any one ingredient to a greater extent than its demands require; therefore a light dressing of fertilizer is frequently just as effective as a much heavier one. This fact is exemplified in the manuring experiments carried out by the Department of Agriculture over a term of seven or eight years in the wheat-growing areas, where it has been abundantly proved that a dressing of 56 lbs. of superphosphate per acre produces superior yields to a dressing of 75 lbs. of the same manure. Furthermore, the addition of manures containing nitrogen, and also of potash, has even resulted in the lowering of the yields of grain, showing that the crop has been over-manured. The question naturally arises: What becomes of the surplus foods that the plant does not use? The answer is that a portion of the nitrogen which has been transformed into nitrates by soil agencies,

being very easily soluble, is leached out of the ground, and goes away in the drainage water. The phosphoric acid and potash find certain bases in the soil, with which they unite, and turn into forms that are not soluble in water. When one reflects that the plant can only utilize food that is held in solution, it becomes clear that all insoluble material is of no service to plant life.

The ideal system of manuring would be to supply the plant with just so much food as it could utilize, and no more. We find, however, that in practice this is difficult to arrive at. The amounts of the plant foods removed by a crop of vegetables are so small that, if we were to restore only what is removed by the crop, it would be difficult to efficiently distribute the commercial forms in which the plant foods occur. To insure uniform distribution it is therefore customary to give an abundant supply. An abundant supply, however, does not mean extravagant use. The force of my argument will perhaps be made clearer by reference to the following table, which shows the amounts of the fertilizing materials removed by *one half-ton of some common vegetables*:

Vegetable.	Water.	Nitrogen.	Phosphoric Acid.	Potash.
	lbs.	*lbs.*	*lbs.*	*lbs.*
Cabbage	905	3·8	1·[illegible]	4·3
Cauliflower	906	2·6	1·6	3·6
Carrot	886	1·6	0·9	5·1
Parsnip	803	2·2	1·9	6·2
Turnip	904	1·8	1·0	3·9
Radish	933	1·9	0·5	1·6
Horse Radish	767	3·8	1·3	9·5
Lettuce	937	2·3	0·7	3·7
Celery	841	2·4	2·2	7·6
Cucumber	958	1·6	1·2	2·4
Pumpkin	900	1·1	1·6	0·9
Onion	870	2·7	1·3	2·5
Pea	126	35·8	8·4	10·1
Tomato	936	1·6	0·5	2·7
Potato	750	3·4	1·6	5·7
Artichoke	811	2·9	1·4	4·7
Asparagus	936	3·0	0·9	2·0
Rhubarb	916	1·3	0·2	3·0

The two facts which stand out prominently in the above table are—(1) That nearly nine-tenths of most crops are water; and (2) that the ingredient which is removed in greatest amounts by almost every vegetable is potash. The latter fact supplies an adequate reason for the whole inquiry.

The General Practice with Manures.

With one exception, where night-soil was made use of, the invariable practice is to use stable manure in amounts ranging from three to twelve tons, or even more, per acre. The amount available seems to regulate the quantity used. The treatment for most crops is the same, except for potatoes and other root crops, where an addition of bone-dust or blood manure (sometimes both) is used. Top dressing is practised to a large extent for the forcing of such crops as cabbages, cauliflowers, onions, lettuce, &c., and especially is this the case when, through one reason or another, these crops are backward. Nitrate of soda, or sulphate of ammonia, at the rate of 2 cwt. per acre, is the manure generally used.

Many of the gardens are drained by tiles; others depend on the natural drainage of the sandy soil. It appears to be generally conceded that artificial drainage is necessary to give the best results. The use of potassic manures is conspicuous by its absence. In only two cases out of a hundred was there any mention made of potash being used; in both cases the results had not been satisfactory. It is possible that the potash may not have been in the most suitable form, nor the amount used sufficient; or it may have been used on the wrong class of plants, and perhaps at the wrong season. All these factors would influence the result of its use. The light sandy type of soils to the south-east of Melbourne is naturally poor in potash, so that the relatively large amounts removed by continuous vegetable cropping can only be restored by one means, viz., the stable manure.

THE ANALYSIS OF STABLE MANURE.

Stable manure is a substance that is liable to be affected by so many influences, such as the kind of animal supplying it, age of animal, kind of food—whether fresh or rotted—kind and amount of bedding, &c., that we can only accept the average of a very large number of analyses as being being fairly accurate. If we assume that a ton of average stable manure contains nitrogen 8 lbs., phosphoric acid 6 lbs., and potash 6 lbs., and that the average annual dressing used by the market gardener is 6 tons per acre, we should find that the following fertilizing ingredients were annually supplied:—

Nitrogen.	Phosphoric Acid.	Potash.
lbs.	lbs.	lbs.
48	36	36

The equivalent of these materials is furnished approximately by —

Nitrogen.	Phosphoric Acid.	Potash.
3 cwt. Nitrate of Soda, or, 2⅜ cwt. Sulphate of Ammonia	2 cwt. Superphosphate, or, 2 cwt. Bone-dust	⅝ cwt. Muriate Potash, or, ¾ cwt. Sulphate Potash, or, 3 cwt. Kainit.

It is usual to supplement the average dressing of 6 tons of stable manure, in a great number of cases, by about 5 or 6 cwt. of bone-dust or blood manure per acre. The amount of fertilizing material thus put at the disposal of the plant may assume large proportions, as follows:—

—	Nitrogen.	Phosphoric Acid.	Potash.
	lbs.	lbs.	lbs.
Supplied by 6 tons Stable Manure ...	48	36	36
,, 5 cwt. Bone-dust ...	17½	110	—
Total	65½	146	36
Or,			
Supplied by Stable Manure	48	36	36
,, 5 cwt. Blood Manure ...	55	4	1
Total ...	103	40	37

If the reader refers back to the table which sets out the amounts of the plant foods removed by various vegetable crops, it will be seen that a very great excess is supplied over the demands of the plant. The analyses alone of the plant, as a guide to manurial deficiencies, are likely to be misleading; but there is sufficient justification in saying that the present amounts of artificial manures supplied are not only excessive, but badly balanced as well. For example, the plants show that, almost without exception, they remove more potash than any other ingredient, whereas the manures, both natural and artificial, restore that ingredient in the smallest amounts.

SUGGESTIONS FOR A REMEDY.

The use of stable manure cannot be too highly commended; but its usefulness is more in the direction of improving the physical condition of the soil than as a direct supplier of plant food. Light sandy soils are deficient in "body," and require vegetable matter, or humus, to enable them to retain moisture. Heavy clay soils, on the other hand, are difficult to work, and require breaking down to facilitate the passage of moisture, air, and warmth. By classifying the commoner vegetables into the groups to which they belong we may arrive at a little understanding of their dominant demands:—

Cole Crops—Cabbage, cauliflower.
Root Crops—Carrot, parsnip, turnip, horse-radish, radish.
Salad Crops—Lettuce, celery.
Curcurbitous Crops—Cucumber, pumpkin.
Bulb Crops—Onion.
Pulse Crops—Peas.
Solanaceous Crops—Tomato.
Tuber Crops—Potatoes.
Perennial Crops—Artichoke, asparagus, rhubarb.

It will be remembered that almost every group is a strong potash feeder. The excessive amount of nitrogen in the pea is largely accumulated from the air, so that direct fertilization in this respect is unnecessary. The pea plant is a strong potash feeder, and should be aided in that direction as much as possible. Seeing that most of the vegetables commonly grown make such demands on the potash supply, it is worth considering how best to meet the needs of the plant in this respect.

The cost per ton of the potassic manures on the Melbourne market is high, viz.—

£13 10s. for muriate of potash or potash chloride;
£14 10s. for sulphate of potash; and
£5 for kainit.

The last-named is hardly to be recommended for vegetable growing, on account of its admixture with common salt. Potash chloride contains from 58 to 61 per cent. of pure potash, and potash sulphate 48 to 52 per cent. The former is, perhaps, the more easily soluble. A "complete" manure (one containing the three principal plant foods) might be made up on the following lines as a basic dressing for all vegetable crops:—

1 cwt. sulphate of ammonia,
3 cwt. superphosphate and bone-dust (in equal quantities),
1 cwt. potash sulphate.

For special crops, however, such as may require forcing for the early market, the addition of 1 cwt. of nitrate of soda as a top dressing may be necessary. The nitrate should not be used until the crops have made a certain amount of growth, because, being extremely soluble, it has a tendency to rapidly leach out of the soil. If the root system of the plant is fairly abundant, it uses up a great portion of the nitrate of soda before it escapes. For this reason, never top-dress with nitrate of soda, if it can be avoided, either just prior or just after heavy periods of rain. The combination of the three manures will be found to assist the working of one another.

CONCLUSION.

Reviewing what has been said in a general way, it will be clear to the person who is desirous of getting the most out of his land that the rational use of artificial manures means a clear knowledge of the dominant wants of each class of crop; the functions of the different plant foods—*i.e.*, the part each one bears in producing a perfect plant—the differences which exist between various forms of commercial fertilizers which contain the same ingredient—such, for example, as superphosphate, Thomas phosphate, and bone-dust; why one should be used, and not the other; why one may be sown in the early autumn, and another may not be used till the spring. A better understanding of the aids to production means economy in money without any deterioration of the output, but rather an improvement in the quality of the product.

THE IMPROVEMENT OF VICTORIAN PASTURES.

FEEDING CLOVER SEED TO CATTLE.

It is commonly observed that pastures become well clothed with grass and clover through the way these seeds germinate in the droppings of the animals. The question has been asked as to whether it will pay to feed such seeds to cattle, with the object of improving the pastures. The following letter from Mr. E. Simpson Hill, Field Officer, speaks for itself:—

"Mr. Young's land at Longwarry is on the poorer soil of the swamp fringe. His method is to sprinkle a handful of mixed clover seed (White Dutch, Cow Grass, and Alsyke) amongst the chaff he feeds to his milking cows. He does not harrow the droppings about in the paddock, but just lets them lie. The result is that he has a fine growth of clover all over his paddocks where none grew before, and where he has even tried to get it to start by hand-sowing, but failed. He attributes the success to the action of the cow's stomach upon the seeds which are partly germinated, and to the plant food which is immediately available upon complete germination. He thinks but few seed are lost in the chewing of the cud, is well satisfied with his experiment, and believes it to be the best way of sowing clover on almost any soil."

TURKEYS, THEIR CARE AND MANAGEMENT.

H. V. Hawkins, Poultry Expert.

In response to inquiries for hints on the management of turkeys and the cause of many fertile eggs not hatching, I intend to briefly outline a few points of primary importance in connexion with their habits, &c.

In the first place, the Turks had little, if anything to do with this breed, so that the name "Turkey" was not given this excellent table bird by them, but rather by the Americans. Personally, I am inclined to the belief that the Mexicans discovered the wild turkey, but the credit of vastly improving and domesticating it, and raising the breed to the present standard of perfection rightly belongs to the Americans. In any case, I am content to know that the Americans have farmed turkeys for so many years, and have wonderfully changed their type, colour, and habits, with such splendid results.

The question so often asked is, "Why turkey farming has been so long neglected here?" Those who have done most for the Commonwealth in this regard, have been the squatters, who, in many cases, merely keep a few at first to supply a change of menu from mutton. They have little time to devote to the care of these birds, still, in most cases, the result has been great success. The reason is not difficult to find, *i.e.*, turkeys, being great travellers and foragers, must have acres. They may be seen in large flocks in the Riverina miles from the station homestead. They have a decided objection to being fed on wheat morning and evening. I have taken particular notice of their method of feeding, and have invariably found that they had good appetites when variety of food abounded, *i.e.*, first a seed, then an insect; possibly a grasshopper would cross their track, and a bad time the grasshoppers get when a flock of 200 bronze turkeys sets sail.

BEST BREEDS TO FARM.

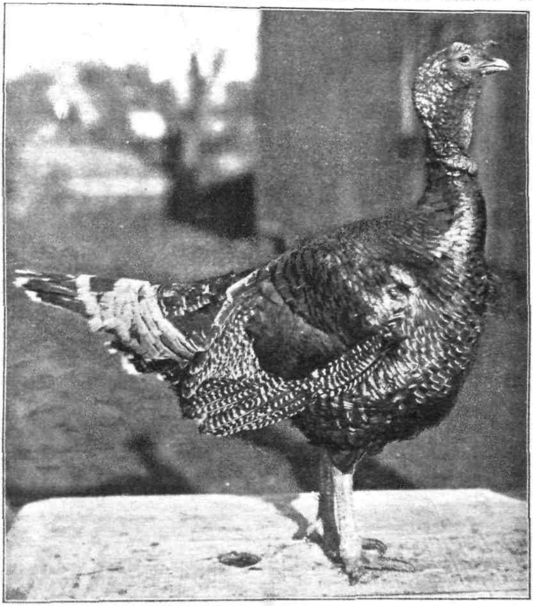
The bronze turkey being large, and the flesh so beautifully white and succulent, is perhaps the breed *par excellence*, yet it should be always borne in mind that the 40 lbs. gobbler is not the most profitable to breed. Birds of 14 to 18 lbs. weight are usually those which the consumer prefers, provided sufficient flesh is presented to the chef by which he can satisfy a fairly large number of visitors. The black turkey gobbler of good size, and two years at least, and unrelated, and twelve to thirteen large bronze hens (two years old), make an ideal breeding flock. Many add a very large bronze gobbler, which is unsuitable for the hens, non-fertilization of the eggs being the result. Each hen averages eighteen to twenty eggs before going broody.

Turkeys need little attention if kept away from fowls and ducks. Turkey farming pays best by itself, and the northern areas are more suitable than the southern. They lay their eggs in a secluded spot; a cement barrel laid on its side with a brick each side to prevent rolling, and a branch of a tree partially covering its entrance, is all they want to encourage them. It is best to permit the eggs to remain in the nest. The hen is usually very cautious on entering and leaving her nest, and seldom breaks an egg, unless she has not had sufficient shell formers in her diet.

See that she gets ample cinders, burnt bones, and charcoal, and, when possible, plenty of dry oyster shell. Much depends on the farmer whether she breaks the egg and hatches her young.

MAKING NESTS, ETC.

Always provide the hen with an inviting spot and plenty of green grass for the nest; a too dry nest often causes trouble—lack of moisture. In



A TYPICAL TURKEY GOBBLER.

districts in the far north I would strongly urge that one side of the barrel be removed; make the nest on the ground, oval in shape, and keep a fair amount of moisture around the nest. Give the hen opportunity to dust herself in a damp spot; she will get it if possible, and there will be little fear of dead chickens in the shell unless breeding from immature birds is practised. A gobbler at twelve months is not the best. He should be at least two years old; likewise the hens. Above all, introduce fresh blood every second year; this is of great importance in the raising of turkeys for

profit. Again, a vigorous gobbler will fertilize all the eggs of a dozen hens in less than four weeks; that is to say, suppose a turkey hen, after she has had the companionship of her mate for say a month, lays seventeen eggs at a stretch, the whole batch laid prior to her brooding will be fertilized. In short, you need only borrow a good gobbler for one month in the season, provided you are not hatching late chicks. See that his toes are not like a razor, otherwise serious results may follow; I have, this season, stitched three beautiful bronze hens, the backs of which had been laid bare.

Of one thing there can be no doubt, turkeys do best in the fresh air, and will not stand coddling; they should be housed in large airy sheds, open completely on the eastern side, with perches fairly wide (three to four inches). The straighter the breast bone, the better satisfied will the consuming public be, and narrow perches mean crooked breast bones. Do not place the perches too high, especially where the ground is hard or stony, as turkeys are, like fowls, subject to bumble feet, which often spoil hens for a whole season. I am quite convinced that turkeys must be encouraged to accustom themselves to shed roosts; they prefer the limb of a tree or the top of a harvester, but that should not be. A little coaxing for a week, a kindly bucket of oats by way of encouragement, will do much to form the habit of coming home each night at dusk, instead of their straying away, or being found in the field in the morning with their heads off—the work of foxes, which are very troublesome in most districts.

FEEDING TURKEYS.

The adult birds usually find most of their own food, yet it is an absolute necessity to feed the flocks when natural foods are not available, *i.e.*, in the autumn and winter they get down in condition if not attended to, although they may have unlimited range. Insect life is then scarce, grass is of poor quality, and is also usually wet, and the consequence is they scour and often die from the effects. Barley meal, maize meal, and bran (one part each), with a fair amount of chopped up boiled rabbit, and when available a few sliced up raw onions, all mixed with the soup in which the rabbit or other animal food has been boiled, should be used. Mix as dry as possible, turkeys do not thrive on slops. Curded milk is much relished, and is a splendid flesh former, and a whitener of flesh; nothing is more objectionable than a *fatty* breast. Too much maize feeding, or a constant supply of wheat, will not improve the colour of the flesh. Oats are by far the best of the grains to assist in keeping down fat.

Fresh Water.—Always provide fresh clean water daily, and keep the vessel out of the sun; neglect in this regard will cause losses by disease. Add charcoal in case of bowel disorders; it is an absolute necessity in successful turkey raising.

Grit.—They must have an unlimited supply of grit, without which they suffer much from indigestion. Small pebbles, coarse sand, and pieces of broken crockery, and smashed up burnt bone all aid in digesting their food; this is especially required prior to their going to roost.

Boiled Grain.—There is no necessity to boil any grain; they are better without it, and prefer the hard food to that of a sloppy nature.

Egg Producers.—The so-called "egg producers," mentioned by some of my correspondents, would, if fed in sufficient quantities, in some cases assist egg production, but at what a cost? The best egg producer is insect

life, and when not available in sufficient quantities, add the best substitute, *i.e.*, beef and mutton scraps, sheep or bullock's liver, or rabbit, soaked in cold water overnight, and then lightly boiled. Use the liquid for mixing the morning meal, and avoid making it pasty, but use the hands well in mixing it hard and friable. Curded milk when available should be a magnificent aid to egg production, and when topping turkeys off for market, give them as much as they will take, as it softens and whitens the flesh; milk fed turkeys eat like six weeks old chickens.

Young Turkeys.—For young turkeys many successful raisers use hard boiled eggs mixed with stale bread crumbs, and a little fine oatmeal, moistened with skim milk (crumbly, not sloppy). This is given the very young chicks for the first week, after which eggs should *not* be given, but plenty of finely pulped raw onion added, and with it milk curds, and a little dry bone meal and charcoal mixed well through. This not only keeps their bowels in order, but supplies the additional phosphoric acid necessary to quick growth of bone, and increases stamina, thus decreasing the chances of "leg weakness," a complaint to be guarded against. Encourage the very young turkeys to eat millet seed at night, and after two weeks feed on hulled oats for best results, until old enough to have a little wheat or oats.

Keep the young turkeys dry. Nothing kills quicker than long wet grass; once they get a soaking, deaths may be expected. Always keep them in confined pens, well sheltered from wind and rain. Do not on any account allow them on the dewy grass, but keep them in until the sun has dried the grass off a little. Examine all young poults for vermin, which is so troublesome at the back of the head and near vent; hundreds of birds die through no other cause. The pest is similar in habits to the tick, holding on and penetrating the skull. The young birds should be freely dusted with insectibane, and a little carbolic paste applied at the back of the head. Neglect in this matter is the cause of many deaths. The fact that late hatches do not develop as fast as the early hatches is of the utmost importance to all farmers of poultry, be it turkeys, ducks, or fowls. The early chicks may be relied on to produce the best results. The longer a hen lays in a season, the more impoverished she becomes as a result of hard work. Thus we find the embryo becomes smaller and weaker, and it is from these late poults we get bad symptoms, first catarrh, often the precursor to a more serious trouble, *i.e.*, roup, or to make it clearer, a running at the nostrils is observed, and later, symptoms show a swollen head, from which arises an offensive smell.

Onion tops, dandelion, rape, and raw onion finely cut, and white clover, are without doubt the favorite green foods with turkeys; and they are rich in mineral salts, and valuable as correctors of the blood. From five weeks old and on, this can be given mixed in the morning food (pollard, bran, &c.)

If the pasture has a variety of grasses, so much the better, as they prefer variety, but if it be a dry droughty spot, sow lucerne in a 1-acre enclosure. After it becomes established, it will keep you supplied with green summer food, being rich in protein, and also an egg producer.

Area.—One hundred adult turkeys could easily be run on five acres, but, unless the owner is compelled to fence, I would advise giving them full liberty, as they will not require so much feeding. It is rather difficult to say whether three feet and three added wires on top will suffice to keep

turkeys in; much depends on the way they have been brought up. If at all wild fifteen feet would not keep them in without doctoring the wing joint.

Domesticated poults are usually tamer than Leghorns, and give less trouble in this respect. I would certainly recommend trying 3-ft. wire, with four plain ones above, but care should be taken when putting in posts. Do not use too thick a post, for this reason, that if the posts are "table-topped" they allow ample room for a gobbler to fly on to; the others will soon learn the habit. Further, wide top posts are a source of great danger where foxes are plentiful. Run the wires above the thick posts, attached to thin hardwood batten. One morning I saw fourteen headless turkeys in a 5-acre enclosure at Buninyong, and traced Mr. Reynard's hair on a thick 6 ft. high corner post, which was 25 inches in circumference at top, and unbarked. Had the barbed wire covered the top of the fence this loss would not have occurred.

I would strongly advise all of my readers who have acres in the Riverina, Wimmera, or Goulburn Valley, to raise turkeys for market, as they will pay equally as well as lambs. Recently at Geelong I saw prime gobblers realize from 22s. to 27s. per pair at auction. A leading Melbourne firm also informs me that prime turkeys, topped off with a good handful of short white oats at night two to three weeks before marketing, will always command top places. During Show week, and prior to Cup week, turkeys sold at their rooms up to 25s. and 27s. 6d. per pair. Dr. Wight, of Kyabram, makes a hobby of raising turkeys, no less than 150 birds being raised successfully by him during last season. Mrs. Goddard, of Moama, has also had great success with them.

The main thing in marketing is to top off and to grade the birds according to size, not putting three big gobblers in a crate with five or six wasters. Mark your crates first, second, and third quality, and you will be quite satisfied when account sales come in. Make the agent your friend, it creates confidence, and he will do his best for you; the farmer who is always chopping and changing about makes a serious blunder. Keep in touch with your salesman; tell him how many birds you will have for disposal, and ask him to wire you when a scarcity of white flesh exists. Don't rush him with twenty crates when ten will suffice; the agent usually knows when to advise you to send, and the cost of a telegram often pays.

BIRD'S-FOOT TREFOIL.

Constable A. C. Dungey, Crown Lands Bailiff, Birregurra.

Bird's-foot trefoil, although brought into this district about forty years ago by a Mr. Hager, who took up land at that time on the Retreat, about 10 miles from Birregurra, has only of recent years attracted much notice. The seed was brought from Germany, and planted by Mr. Hager in his garden, from which it spead over the adjacent lands. Later on the property was purchased by Mr. Armytage, whose manager, Mr. E. Hayes, about eighteen years ago let one of the paddocks to Mr. H. Gladman. The latter, when ploughing the ground for the purpose of growing oats, had difficulty in doing so, owing to the great mass of roots. The attention of Mr. Hayes was drawn to it, and he noting that the plant was kept so close by stock, and that when protected it grew so strong—it

choked the oat crop—decided to submit specimens to the then Government Botanist (the late Baron von Mueller), who identified the plant as *Lotus corniculatus.* Mr. Hayes had the paddocks of the Ingleby estate planted with the trefoil, and recently he has planted it on his own land.

After Mr. Gladman left the Retreat he selected land at Forrest, where through sowing the trefoil, or through the hay grown on the Retreat being used there, that portion along the east branch of the Barwon, which runs through the property, became covered by it. The land was subsequently abandoned, and was lying idle and open for some years. It became a favorite haunt for stray cattle; working bullocks from saw-mills in the locality could not be kept off it, and owners of these stock soon discovered that the trefoil was the attraction. On the Crown lands in the locality where these cattle were wont to run and work, the plant has become established through their droppings. About five years ago Mr. H. Duck went to Forrest, and rented the unoccupied house. He kept a cow, and although there are only about 3 acres of good land on the block, he found the cow did so well that he obtained additional stock, purchased the property, and then turned his attention to cultivating the trefoil. He did this by transplanting the roots on to the poor bracken land, and scratching in seed here and there. The result has, no doubt, been a surprise to himself and all who know the property, which was looked upon as one of the poorest selections in the forest. He has about 40 acres enclosed; on this he has milked twelve cows and fattened several during the last year. His cows averaged about 10 lbs. of butter a week, and the butcher (Mr. A. Muir) who killed the fats describes them as equal to the best he has had in this district. So pleased was he that he purchased £10 worth of the seed, and had it sown on a selection he owns at or near Boolarra. Mr. A. Sanderson, sawmiller, who has had experience of the plant, his bullocks constantly having cleared out to feed on it, also obtained £10 worth of seed, and put it on his property at Forrest. The seed and plants have been sent from this district by Mr. Duck and other residents for years past, but all those who have it on their land state it came from the Retreat originally. The plant is a very heavy seeder, and in that fact, I think, lies its virtue. It starts to seed in October and November, and continues to do so right into the winter as late as June. I find it prefers to grow in wet places, and is seen along all the creeks, growing on the banks that are submerged occasionally; this may also be accounted for by the fact that stock cannot get it readily at these places, for it is difficult to find it where stock have free access, sheep particularly cropping it bare. It seems to grow in any soil, and will take possession of land covered with rushes, which appear to die out as the trefoil grows among the roots. At Forrest railway station yard, which was excavated out of a hillside, the plant is growing in the yellow clay; in another place, on top of a hill, where the surface soil of an old track, beaten hard with years of heavy traffic, has been washed away, it grew well during last summer, and spread for yards from where the seed was deposited in cow manure.

I have no doubt that this fodder can be grown with advantage in any of the cool districts, and also in dry districts where it could be irrigated. It would do well, I believe, in these districts when once established and rooted to the sub-soil, more particularly if the surface were broken occasionally with heavy harrows, &c., as it seems to improve the more it is torn about. Its roots take a lateral direction beneath the surface, and at

every joint shoots are thrown up to the surface. These shoots stool again, and at all joints touching the ground root very like couch or buffalo grass.

NOTE.—The Government Botanist states that the fodder plant mentioned by Constable Dungey is the *Lotus corniculatus*, L., variety *uliginosa*, formerly known as *Lotus major*—the Greater Lotus, or the large Bird's foot Trefoil. As indicated in the article, it does well where moisture abounds. The common variety of *Lotus corniculatus*, which is abundant in many English pastures, and which is a smaller plant, rooting less freely laterally, but penetrating deeply, and seeding abundantly, would be better adapted for drier situations, though not able to stand extreme drought. Seed of both forms can be obtained from seedsmen in Melbourne and elsewhere. The variety *tenuis* is of use for sandy soil around sea coasts.—EDITOR.

DISEASES OF FARM ANIMALS.

S. S. Cameron, M.R.C.V.S., Chief Veterinary Officer.

V.—NOTIFIABLE DISEASES UNDER THE "MILK AND DAIRY SUPERVISION ACT 1905."

(Continued from page 655.)

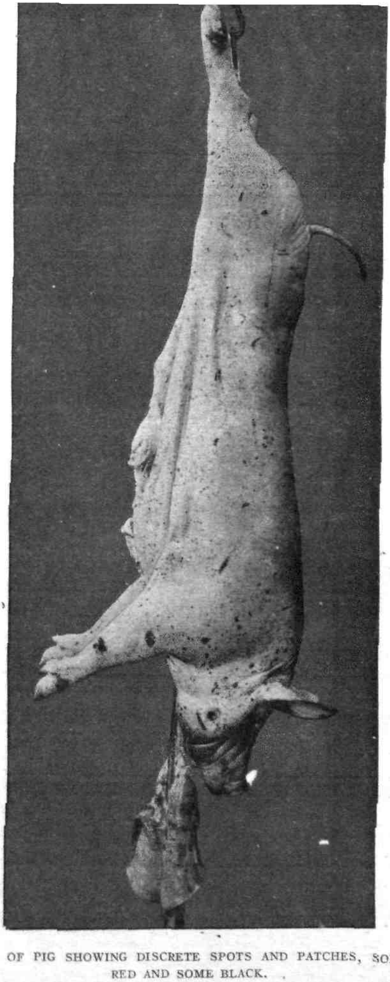
Swine Fever.

Great confusion has existed heretofore, and does even now exist, in regard to the nomenclature and bacteriology of a series of infective fevers in swine, which for practical purposes may be grouped under the common name of "Swine Fever." Amongst these are:—Swine erysipelas, the American "hog cholera," the French "rouget du porc," and the German "Schweineseuche." They all belong to the group of diseases known as the "hæmorrhagic septicæmias"—that group having causative organisms of which the fowl cholera bacillus is the type—and it would appear to matter little, from a practical point of view, whether the diseases so differentiated are actually different, or whether they are simply different manifestations of the same disease, for they are alike infectious and fatal, and the measures to be adopted in dealing with them have consequently to be on the same lines.

This view of the matter was upheld after full discussion at the Inter-State Stock Conference, held in Melbourne, September, 1906, when it was unanimously resolved, on the motion of Mr. A. H. Cory, M.R.C.V.S. (Queensland), for adoption by State Government authorities —

> That for administrative purposes it is desirable that the term "swine fever" be taken as including any of the contagious or infectious diseases of swine of a hæmorrhagic septicæmic character now variously termed "swine fever," "swine plague," "hog cholera," and the like.

The author's complete adherence to the doctrine of the mutability of organisms has been previously indicated, and the view may now be put that these hæmorrhagic septicæmic diseases of swine seem to furnish one of the best examples of that change in character of pathogenic organisms whereby a different manifestation of disease is brought about by the same, though modified, organism. Nocard's earlier view—that swine plague,



I. CARCASS OF PIG SHOWING DISCRETE SPOTS AND PATCHES, SOME BEING RED AND SOME BLACK.

swine erysipelas, and hog cholera might be caused by the same organism, which had become modified in its direction of virulence by environmental, nutritive, or other influences—may be taken as sound, even though, in his later writings, he would appear to have discarded it. It has even been recently suggested by one of Australia's foremost bacteriologists (Dr. Cherry) that the outbreak of Swine Fever throughout the Commonwealth in 1903 may be not remotely connected with the dissemination of fowl cholera organisms which took place during the nineties, when the organism of that disease was used in an attempt to spread an exterminating disease amongst rabbits so little different in characteristics are the organisms of the two diseases.

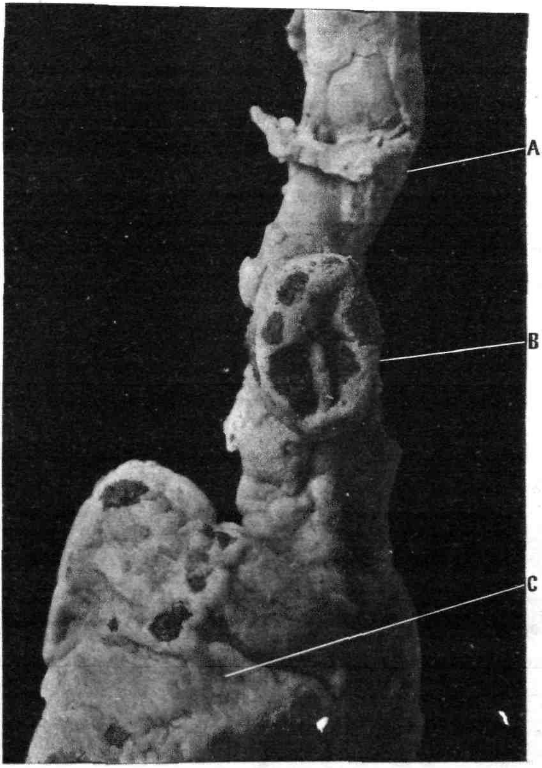
INTRODUCTION TO AUSTRALIA.—On the question of the introduction of the disease to Australia various opinions are held, but the view that it has been existent throughout Australia for many years is based solely on speculation and assertion. Not a scintilla of reliable evidence in support of such a view has been forthcoming, while the evidence of its being a new visitation to these shores is convincing to those who had the opportunity of closely studying it at the time of its greatest incidence.

Its behaviour was, at the outset, identical with that of all newly-introduced diseases, in that its virulence was very marked and the mortality exceedingly high. It was no uncommon thing for 80 or 90 per cent. of the pigs in large piggeries to be carried off, and on not a few farms upwards of 200 pigs were lost in the course of a few weeks. After the lapse of three years, however, the usual modification of virulence and mortality has been experienced. The outbreaks are fewer in number and milder in type, and the mortality has been lessened by fully 50 per cent. It must be remembered, too, that Swine Fever was a disease the features of which were familiar to many veterinarians in Australia; yet, until the initial outbreaks in 1903, these features had never been observed or recognised. Then, almost simultaneously* in Queensland, New South Wales, and Victoria the disease was definitely recognised. But the experiences at the Melbourne City Abattoirs were still more eloquent of its being a new disease so far as Australia was concerned. From the commencement of the Meat Supervision Act, in 1901, all pigs slaughtered at the Abattoirs —about 1,000 weekly—had been subject to *post-mortem* inspection in a special manner by a particularly expert officer (Mr. Moog), who, it may be assumed, after experience in the detailed examination of two years' supply of pigs (100,000 carcasses), would be reasonably familiar with the usual or current abnormalities. Yet none of the features of Swine Fever were observed, until suddenly a number of pigs were found, week by week, to present appearances, *post-mortem*, which had never before been seen, and which were the characteristic lesions of Swine Fever. Suppose a life-long peach-grower suddenly found his orchard infested with peach-leaf curl, would he not be justified in regarding the pest as a new introduction, and not that it had been there all along and unobserved by him?

DEFINITION.—Swine Fever may be defined as a specific contagious bacteridian disease of swine, characterized by such successive signs of fever as congestion, ecchymosis, extravasation and necrotic ulceration, particularly of the mucous lining of the gastro-enteric tract, accompanied by fœtid diarrhœa; characterized also by certain circulatory changes of the skin.

* On the question of priority of "discovery" of Swine Fever in Australia, claims have been made which are not justified by the facts. The files of the Board of Public Health, Victoria, contain a memorandum by me of date 16th March, 1903, in which I reported the occurrence of the disease at the Melbourne City Abattoirs.

with a tendency to dermal necrosis, and frequently also by acute pneumonia; and accompanied by a high mortality which, in different



2. ENLARGED ILLUSTRATION OF PORTION OF ILEUM AND CÆCUM SHOWING ULCERS.

A. Ileum. B. Ulcers on region of Ileocæcal valve. C. Cæcum.

countries, has ranged from 50 to 80 and 90 per cent. of the animals affected.

PERIOD OF INCUBATION.—The time elapsing between exposure to infection or inoculation and the development of symptoms may be placed at from six to fourteen days, but variations in either direction of this period may occur, as short a time as three days, and as long as thirty days, having at times been known to elapse. Such variations appear to depend, to some extent, on the prevalence of conditions which would be likely to diminish or increase the resisting power of the animal. For instance, during periods of extreme heat or excessive cold the period of incubation tends to be shortened.

SYMPTOMS.—In ordinary cases the first symptoms noticed are listlessness, dullness, avoidance of movement, the pig lying hidden away in a secluded corner. Shivering fits may be noticed, and there is loss of appetite, great thirst, dull, anxious expression of countenance with drooping of the ears and tail, constipation with hard, rounded, glary, dark-coloured fœces, or sometimes fœtid diarrhœa. Attempts at vomition are also frequently observed in the early stages. These symptoms are, in the majority of cases, accompanied by the appearance of red hyperæmic blotches on different parts of the skin, giving the pig the appearance of having been splashed with red ink. (See Plate 1.) These blotches are effaceable, the *redness dispersing on pressure, and the part remaining pallid until re-*suffusion with blood occurs. Well-marked petechial spots or extravasations of blood, of a deep red or purple colour, occur on the ears, lips, nose, tail, belly, rump, inside of arms and thighs, and on the extremities. There is usually a discharge from the eyes and nostrils, at first thin and watery, but ultimately becoming sticky and purulent, and forming a dried concretion around the orifices. Later on the respirations become increased and laboured, and a cough is present, especially when there are lung complications; a fœtid diarrhœa succeeds the constipation, and the fœces may be blood-stained. As the disease advances, the gait of the animal is altered. He may be lame from sores about the fetlock and knuckles; there is gradual loss of co-ordination and control of the limbs, indicated by stiltiness and jerkiness of movement, particularly of the hind extremities, and if the animal lives sufficiently long partial paralysis succeeds. In the later stages the hæmorrhagic patches on the skin become necrosed, and sloughs or bedsores may form at points subject to pressure or injury. In black pigs the red blotching is not readily observed during life, but the practised eye may detect the skin changes in parts where there is little hair, by the shiny glossiness and deep-purple colour presented.

DURATION OF DISEASE.—Such would be a description of the general run of cases, and in these cases death may be expected at any time from seven days to three weeks or a month from the onset; but in some outbreaks the disease runs a more acute and rapidly fatal course, killing within a day or two; and in others, again, the disease assumes a chronic type, in which recovery may be protracted over three months.

POST-MORTEM APPEARANCES.—Above everything, the appearances presented to the naked eye on *post-mortem* examination form the most reliable guide to diagnosis. Some of these are indicative of a general blood-poisoning, and others are special to the complaint. Particularly is this the case in regard to the ulceration found on the mucous lining in the neighbourhood of the ilio-cæcal valve at the junction of the large and small intestines. (See Plate 2.) The ulcers stand out prominently, and are composed of layers or rings of a dirty-white, brown, or black dead material. They are frequently round, and vary in size from a sixpenny

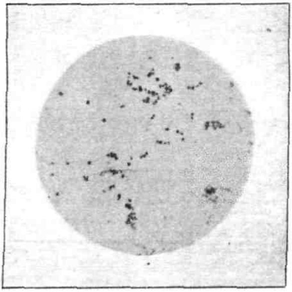
piece to a pin's head, but they may run together and form a large, irregular shaped ulceration. These ulcers may, in some cases, occur in other parts

3. PORTION OF STOMACH OF PIG SHOWING INFLAMMATION OF MUCOUS MEMBRANE. SHADED PORTIONS WERE INTENSELY RED.

of the intestines, and while their presence may be taken as completely diagnostic of the disease, their absence, on the other hand, does not imply

that the animal is not affected with Swine Fever. Sometimes the ilio-cæcal valve is only slightly involved, but the mucous lining of the stomach may be deeply inflamed, presenting extensive hæmorrhagic patches and ecchymosis, while in some places it may be dead and sloughing. (See Plate 3.) The lungs may show a diffuse pneumonia, with ecchymosis and large hæmorrhagic patches. The liver is frequently swollen and ecchymosed. The kidneys may present the same appearance. The spleen is frequently unchanged to the naked eye, but in the spleen of some pigs there are hæmorrhagic nodulations on the surface, which give the organ a mottled appearance. The lymphatic glands throughout the body, but especially those receiving lymph from the parts where the most pronounced lesions exist, are congested, the congestion being most marked towards the surface.

Bacteriology.—Bacteriological tests are by no means so conclusive in forming a diagnosis in this disease as they are in many other infective diseases, or so reliable as the well-defined naked-eye appearances. The causative germ is a bacillus belonging to the fowl cholera group. (See Plate 4.) It is a short, oval, motile bacillus, from 1.2 to 1.5 microns



4. BACILLUS OF SWINE PLAGUE (X 1,000), STAINED WITH CARBOL-FUCHSIN.

long, and presents the other leading characteristics of its group (for which reference must be made to a work on bacteriology). It maintains its vitality and virulence in soil at ordinary temperatures for at least four months, and in water for a longer period. In the eminently suitable environment which the filthy and insanitary condition of the pigstye usually affords, it has been shown that the organism persists and remains infective for fully twelve months; and consequently it is a standing prophylactic rule that infected styes, yards, and paddocks must remain uninhabited by pigs for at least that length of time.

Note.—The plates illustrating this article have been previously used in an article by Dr. Brown, in the March, 1904, issue of the *Journal*, and were prepared from specimens kindly lent by Inspector Batchelor.—Editor.

COW POX.

(*Variola Vaccinia*).

Cow-pox is a specific, eruptive, febrile, and contagious disease of cattle, allied to small-pox in man, and characterized by the eruption on the udder and teats of vesicles and pustules. It has an incubative period of about four days, after which small, hard nodules appear under the reddened skin of the udder. Small blisters or vesicles then form at the nodulated parts, and are surrounded by a ring or areola, red and congested. About the eighth or tenth day these vesicles become transformed into pustules containing matter, and having a "pearly" appearance. The pustules dry up after two or three days, and are succeeded by a brown scab, which ultimately peels off, leaving a slightly depressed mark. The vesicle or pustule of true cow-pox may be distinguished from an ordinary sore by the fact that, at whatever stage, it has a depressed or "pitted" centre. The vesicles on the udder attain the size of a threepenny piece, and are circular in shape, while those on teats are usually oval. The disease is conveyed from cow to cow usually by the hands of the milker, so that it is advisable that healthy cows should not be milked by persons who have recently milked infected ones.

TREATMENT.—Beyond controlling aggravation of the sores by the usual treatment for sore teats or false cow-pox, little further attention is necessary, as cow-pox is a benign disease, and runs a definite course without occasioning much constitutional disturbance. The milk, however, is rendered unfit for food, and may be a means of communicating the disease.

SILOS AND SILAGE.

A. S. Kenyon, C.E., Engineer for Agriculture.

The increase in the use of silage amongst dairymen and graziers is marked. Those who had silos put up last year are filling them again this year, and in many instances are erecting further ones, while the neighbours have seen enough to convince them of the profit arising from feeding with silage, and are also building. The vote of £1,000 granted this year for advances to farmers desirous of trying the experiment of silo feeding was quickly exhausted. A further sum of £1,000 was provided by the Honorable the Treasurer, and, with but half the year gone, sufficient applications have been received to exhaust this also.

Several farmers have given their experiences on the subject of silage, and these are worthy of perusal.

Mr. W. Hicks, Rutherglen, writes:—

I am pleased to say that I am more than pleased with the results. From 35 cows, 30 of them being on their first calves, for the month of November, our best spring month (without ensilage), my cheque was £32 2s. 6d.; in December started to feed ensilage, and received £25 18s. 6d.; for January, though cream was down ¼d. per lb., and no green grass whatever, the amount was £24 18s.; February, the weather still very dry, £23 15s.; March, £23 14s. 7d.; in April, my brother and I having bought a larger estate, we shifted our cows on to much better grass, but without the ensilage, the receipts fell to £17 10s. I have still about 2 feet in the silo, but have been unable to use it on account of it being so far away. We intend moving the silo when the roads get good, and if possible erecting another for the coming season. I filled the silo with Algerian oats off about 18 acres of ground; the crop was very light, and I cut it when it would make good green hay. I think the results would have been better if I had cut it a few days earlier. I estimate the weight in the silo at close on 60 tons; we feed at the rate of 25 lbs. per cow per day. I think

the better the chaff is cut the better the results. We broke the face of chaffcutter when about half-way up the silo, but we kept going for about an hour, and a lot of long straws went through, and when we came to them, when feeding this silage, it was not nearly so good in condition. I think, also, that builders of silos should be made to understand how necessary it is to tramp the stuff well while filling. I kept four men continually going, and for an hour or so a couple of times a day I had as many as eighteen school children as well. I had less than 2 cwt. of waste, but the result from a neighbouring silo was not nearly so good, and I think the whole trouble was not enough tramping.

Messrs. Tobin Brothers, Eskdale, say:—

The silo was filled with maize, chaffed, when the grain had just passed the milky stage; another silo was filled by us about a month later, but we consider the first made the better feed, as it was not so dry. About 6 acres sown with the drill, 35 inches between the rows, was enough to fill a 60-ton silo. The cows are fed about 50 lbs. per day each, and eat it readily. In our opinion, the silo should have more posts in the foundation as the spans between the posts are too great for the bands, which have warped considerably. In building the second silo we put 16 posts round the circle instead of 8 in the silo built by your Department, and all who have seen it are of the opinion that it is more substantial.

The "warping" of the hoops between their supports on the foundation posts is due to leaving the studs unsupported at the bottom. They should have a block of wood, brick, or stone put under the centre one in each bay at least. The span is too long for a beam curved in plan.

Mr. A. Mountjoy, Dean's Marsh, states:—

The crop used for silage consisted of 10 acres of oats.

Stage of ripeness.—A little beyond the stage that it should have been cut for hay.

Amount put in silo.—About 50 tons.

It was fed to 60 cows (milkers), and lasted ten weeks.

The cows were badly affected with cripples, and the ensilage completely cured them, as during that time they did not get an ounce of bone-meal or salt.

The gain in quantity of milk was not much—2½ gallons per day for the lot, but the cows gained in condition. I think this was owing to the crop being too ripe when cut.

There is no doubt that this opinion is correct. The silage would be light weight, and comparatively low in food value, being cut so late; but its great merit as a cattle food is shown by its effect upon the health of the herd.

Mr. H. E. D. Kelly, Wodonga, relates:—

The silo was filled on 18th December, and took a day and a half to fill, a steam chaffcutter being used. The crop was a little too ripe when cut, owing to the delay in erection of silo. About 18 acres, about two-thirds wheat and one-third English barley, in the latter was a little Cape barley, were cut. The silo was filled to the top, and afterwards weighted with sand. It was opened on 15th May, and some waste around the edges was found.

Fed the dairy cows daily with about three-quarters of a bag each. During the flood there were only a few islands left, and only for the silo we would have had to move the cattle. Some cows were brought on from two pints to a gallon and a half per day.

Mr. H. Jacob, Mildura, gives some practical talk:—

In giving details of my experience of silage making and feeding, I may say that through several causes, namely, lateness in erecting silo, watering the land, rain, and breaking of chaffcutter, considerable delay was experienced in getting started. Notwithstanding this, the result has been very satisfactory, as everything is now in good running order, and I shall next time have things well under control.

The crop, about 1½ acres, was maize, planted in January. It was ready for cutting in April, but I could not cut it, as the silo was not completed till middle of May. By then we had some frosts, which bleached all the green out it; this left it dry and brown, only the cobs, which were perfectly ripe, being readily eatable. It was not till the first week in June that the cutting was finished.

The weight put into the silo was about 30 tons, but that amount was not there at one time, as I was feeding the cows from the silo during the filling, which spread over three weeks. When finished, it was 8 feet deep, and contained about 23 tons. I allowed each cow 30 lbs. weight per meal, fed in the morning. Previous to this they had green barley, but with the change to maize silage there was no falling-off in the milk. During the period of feeding every cow has been quite healthy. I allowed the horses 20 lbs. each, but they do not like it so well as the cows.

On the top of the silage I had about 6 inches of waste. The sides had an average of 1 foot all around, reaching down to the ground. I presume the air must get in through the sides. It was well trodden, but not weighted.

As the crop falls down it gets divided into three different grades. The heaviest, or grain, is thrown against the far side of silo; the stalk comes second, about the middle; leaves or flag third, and fall almost straight down. This means that it has to be mixed up again to make even feed. To prevent this take five chaff bags, cut the bottom open and sew them together, making a bag-chute 20 feet long, which should be hooked on to the top of elevator. The crop would then fall down without dividing. By sticking a hay fork into silage, and tying the side of chute to fork, it could be taken around the silo to any part which required it. As the silage rises, it could be rolled up and pinned with a few nails, keeping it about a yard above. It would save all trouble of levelling, as it would only be necessary to move the hay fork where required and fill up the hollows.

Mr. James Fair, Boweya, is satisfied:—

I filled the silo with about 10 acres of wheaten crop, cut when just in flower. It held about 45 tons, and I fed 40 lbs. a day to each cow. The results have proved very satisfactory, and it is without a doubt the best food for cows that I have tried.

Mr. J. C. Stehn, Morea, *via* Goroke, expects to get better results. He says:—

I did not keep any records of feeding. I used the silage for cows, horses, and sheep, and they were all very fond of it. It was good down the middle, but round the outside there was a great waste; on the whole there was about one-third waste, but I think that was because I put the iron on the wrong way. I started at the bottom, and kept the lap on the inside, and as the wet ran down the outside to the join it came in and spoilt the silage, but I intend to lap the iron the other way and fill it up again this year. I cut 14 acres of wheat when the flower was on it, but I think it would have been better to have cut it a little greener, as it would have pressed together better; I put in about 32 tons. I built it from the instructions taken out of the *Agricultural Journal*.

Messrs. Macdougall Brothers, Minyip, go fully into the question:—

It has proved eminently satisfactory, so much so that we feel satisfied that any farmer having stock to feed requires only to have the experience of its benefit to consider a silo an indispensable adjunct of his homestead. Our silo is built on the plans furnished by your Department—circular, 15 feet diameter by 37 ft. 6 in. in depth, 10 feet of this having been excavated and built with bricks laid in cement. It has a conical roof covered with ruberoid. Our first experiment in ensilage making was last season, when we built the first over-ground instalment of the silo 15 feet high, filled it with chaffed oaten hay, cut somewhat green, and weighted it with two waggon loads of sheaf hay, which, being built in the form of a cone, served the double purpose of a roof and a weighting. The quality of the ensilage, owing to insufficient weighting, was not as good as it should have been, being too black. Still, our milking cows ate it greedily, and so satisfied us that it was well worth our while increasing he size of the structure to its present dimensions. This season's filling was half Cape barley and half Algerian oats, both crops being cut somewhat on the green side. We filled it up to the top, and when it had sunk some 6 feet again filled it up, but applied no weights whatever. The result was that, for some 6 feet from the top, it had this calcined black appearance from over-heating, and which we think should be avoided as far as possible in making ensilage. The balance, from this point downwards, was, we think, as perfect ensilage as could be made from the materials used. It had a rich light-brown appearance, and smelt similar to dried figs. We have fed it freely to milking cows, working bullocks, and horses, all classes doing equally well on it, and greedily fond of it. As we had

a good bulk of it, we did not feed to measure or weight, so cannot give any opinion on ration feeding, except the well-known fact in connexion with ensilage as a food, that it is very satisfying, and, though animals are greedily fond of it, yet they do not consume large quantities of it at a time. The lasting quality of feed made into ensilage is, in itself, a very high recommendation. Of course silos, no matter how economically built, cost money at the outset, but after two years' trial we feel sure that a general adoption of this mode of storing food will prove the only method of avoiding the heavy losses of stock from the periodical droughts to which we are subject.

The quantity of crop necessary to fill the silo was cut off a paddock of 15 acres, and we have been feeding it liberally to some 40 head of cattle for seven months. We are now within a few feet of the bottom.

Four silos were built in the Nhill district in conjunction with the local agricultural society. It was intended that the silage should be used specially for the purpose of feeding sheep; but, owing to the fact that the rain came earlier than usual last autumn, a good growth of grass came away before it was necessary to begin feeding the ewes on the silage. After the sheep had been feeding on the grass they refused to take to the silage, which was not of excellent quality. During the month of June steps were taken by an officer of the Department to see if it were not possible to induce the sheep to take kindly to the silage, but after persevering for about a month the attempt was given up without success.

The replies received from a number of other farmers who fed sheep successfully on silage last year seem to indicate that sheep will take readily to the silage, and do well on it, if feeding is started during the height of the hot, dry weather in the summer. It should be borne in mind, however, that it is often difficult to get sheep to change their habits of feeding, and therefore a first class sample of silage, attractive in taste and smell, goes a long way towards insuring success.

Mr. R. G. Landry, Diapur, had mixed success and crops:—

I had the silo only half full, as it was not erected soon enough. Some rye, oats, and barley mixed, were stripped first, and then the straw put in, which filled about 2 feet. When it settled, the balance was filled with rye, peas, barley, and oats mixed, and a load or two of clean Algerian oats and one of white oats, weighted with logs of wood. About a week afterwards I put in about 6 tons of oaten straw, rather on the green side, and cut immediately after being stripped; this made very good feed. I commenced feeding 225 sheep on the 1st March, and continued until after the rain at the end of May, but did not keep a record of the weight; I should say about 240 lbs. per day were used. I was also feeding cows and young cattle. The top was all good silage, but when I got down about half-way it was mouldy all round the sides; about 4 inches next the iron were rotten, then about 9 or 12 inches were mouldy; but the cows seemed to like it the best. I think the layer of rye straw chaff in the bottom was the cause of it going mouldy. The ewes, all but twelve which had lambs, were dry; I cannot say the sheep did well, but if I had not got the silo I believe half of them would have died, as I had to take them 2 miles to water.

Mr. John Bond, Nhill, asks for suggestions:—

The crop cut was oats off about 20 acres. About one-fourth of the ensilage made the previous year was left in the silo. No account kept of weights fed to sheep or other stock. Our sheep did not care for the ensilage, owing to $1\frac{1}{2}$ inches of rain falling in March, causing a spring in the grass. A dry spell then followed, when we tried them with silage mixed with chaff, then bran and also oats, but they stuck to the natural grass.

The loose horses and cattle, as well as the milking cows, have been fed all the winter. They come regularly night and morning to the silo to be fed, and are very fond of it, and it has maintained them in good condition with sleek coats.

We cut for silage about three days before we cut for hay. We find that from 5 to 6 inches, where the ensilage comes in contact with the iron, rots, though we had two men and a boy trampling whilst being filled; the horses and cattle do not reject it, but it cannot be so nutritious.

Is the heat of the sun on the iron the cause of this, and, if so, would a shield of weatherboard or ruberoid counteract it? I should be glad to hear other farmers' experience, as 6 inches on the outer circle of the ensilage mean a tidy lot.

Our intention is to re-fill every year and erect others, say, one silo to every 640 or 1,000 acres, when we shall feel insured against loss by drought.

There is no likelihood of the waste being due to the sun's heat. It is caused by excess of air—*i.e.*, oxygen—in the silage, and can only be avoided by well trampling and weighting the silage. The time of cutting also appears to have some bearing on the matter. Other experiences and practical suggestions will be welcome, as silage made from hollow-stalked cereals, such as oats, wheat, &c., is unusual in other countries; consequently we shall have to learn from our own mistakes.

Mr. Charles Bamford, Benalla, gives some useful details and suggestions:—

The silo that was erected by the Department on my farm last year was filled with a green crop of wheat, which, I think, was rather far advanced, as the flower had all fallen. In filling it I had the stuff carted from the binder to a steam chaffcutter, and was finished in four days within 1 foot of the top; three days after that I covered it down with 15 inches of earth. I took the temperature at different times for the first three weeks, and it never got above 110 degrees, but when I went to open it (six weeks after filling) it had risen to 135 degrees. On the top there was a mould about 15 inches deep, which was waste.

I started to feed about the middle of January, and out of 50 cows there were only about six that refused the first feed; it was six weeks before some of these took to it. Before I started to feed the cows on it I noticed a good many of them chewing bones, but after feeding for some time this had completely disappeared, which, I think, was owing to the scouring out they got. The feed did not appear to increase the yield of milk much, but arrested the fall, as I had as much milk at the middle of February as I had when I started. I fed 50 cows twice a day for one month, about 14 lbs. per feed, or 28 lbs. per day per cow, which would amount to about 18 tons 15 cwt.; and 40 cows for one month, same rate of feed, 15 tons; and one-third left in silo, 17 tons. Total, 50 tons 15 cwt. For improvements, I would suggest (1) that there be some kind of covering for the stuff when opened; perhaps it could be made out of lining boards, and made in quarters so one quarter could be used at a time; this would prevent the hot air having such a drying effect on it. (2) That there be doors on outside of port-holes. (3) That the roof be put on so it could be spouted.

Mr. James Baker, Gheringhap, writes:—

With regard to silage for the present season, I have used it for feeding young cattle rising two years. They were very fond of it, not leaving the silo all day for some time; but now, not getting so much, they go and feed during the afternoon, but always return to troughs to camp till morning. I have not used the silage as intended, as when planting the maize it was for feeding ewes and lambs; the rains having come before I had the silo erected, I did not attempt to feed the sheep, so fed the cattle and saved the grass for the sheep. It is my intention to use it for the sheep next year. I have a crop of barley growing at present, and will have maize later on.

The following particulars of the crop are furnished for your information:—Maize and ambercane. Maize, fair, ambercane good, planted in rows 28 inches apart. Acres cut, about 8, two of which were ambercane. Ripeness, maize nearly ripe, but was sprinkled with water, to which some molasses was added, which I had on hand; this is coming out in good order. Ambercane green, but well shot out. Amount put into silo, about 50 tons, according to table of capacity. Weights fed to cattle, for the first month 40 lbs., after that and now, 30 lbs. General observations or suggestions—None; do not at present see any room for improvements.

Mr. W. T. Hoare, Apsley, says:—

I fed over 500 ewes, as well as a small flock of stud merino rams, and found the results so satisfactory that I am erecting another silo; my example is being followed in the neighbourhood.

Steps are being taken this season to obtain, as far as possible, observations of the stage of ripeness when cutting, amount of consolidation, and

temperatures after filling, as these are the main points, particularly as regard the hollow-stalked crops, on which any doubt exists. For sheep feeding more care requires to be taken, as they will not readily take to anything but a good sample of silage. Cows are not so particular, but still inferior silage does not give full profit, it having, by excessive oxidization, lost some of its food value. Every effort should be directed towards getting the best sample possible. It will be well to repeat the instructions as to filling, which appeared in the *Year-book of Agriculture* for 1905:—

1. Before filling, whitewash the inside with a thick wash made of lime and skim milk. As this dries in a few minutes, it is sufficient to whitewash the iron each evening high enough to allow for next day's filling.

2. As the ports are placed in position, see that they fit closely all round. If necessary, use thin clay to lute the joint.

3. As the filling goes on, it is impossible to tramp it down too much, especially at the sides. Get the youngsters from the nearest school to spend a couple of hours in the silo each afternoon.

4. From 4 to 10 feet of filling a day is a satisfactory rate.

5. When full, wet the top layer of silage thoroughly. Then spread a layer of old cornsacks, and cover with at least 6 inches of sand or earth. This is specially required when the silage is made of one of the cereal crops, but it is not so necessary if maize or ambercane is used, although even then it is an advantage. A cover made of bags sewn together, and tarred, will last several seasons.

6. The shorter the stuff is cut, the better—½ inch is better than 1 inch.

7. The elevator requires to be driven slowly for a chain-belt elevator, but quickly for a blower.

8. The ordinary chaffcutter, with horseworks, will fill a small silo, but an engine is better for the larger sizes.

9. Arrange the work of filling so that the sheaves are carted direct from the binder to the cutter.

The lime washing is of the highest importance, and should on no account be omitted. Its purpose is mainly the preservation of the iron lining from the corroding juices of the silage. Cutting green stuff, particularly oats, with an ordinary chaffcutter, or even with the silage cutters, requires care and experience. Careful watch must be kept that the rollers do not get clogged. Feed around the edge of the silo, and trample there in particular; the middle will look after itself. Seal the top, unless feeding back is to take place at once, with a layer of straw chaff or other worthless material, well soaked with water, about 12 inches in thickness; and in the case of oats, wheat, &c., put on as much weight as practicable.

The best elevator, when properly made, is the chain and slat box elevator, driven from the bottom, preferably with chain and sprocket wheels. The up-shoot and down-shoot should both be completely closed in, so that any silage carried over is returned to the bottom without waste, and that none is blown away. The dimensions of the elevator should be about 12 inches in width and 4 inches in depth. The slats are 3 inches deep and 2 feet apart on the chain. The speed may vary from 180 to 240 feet per minute—that is, 3 to 4 feet per second. The cutter should, if possible, be placed so that the wheel, in revolving, throws the cut stuff in the direction the elevator is running. The chain elevator takes about ¼-horse power to drive it, and it will easily take up the full quantity cut by an ordinary-sized cutter, No. 1 or No. 2. The blowers attached to

the large American silage cutters take about 8-horse power to run them. Experiments are in hand to make a small blower capable of being driven by a horseworks along with the usual type of chaffcutter.

The Editor will welcome any correspondence upon the subject of silage.

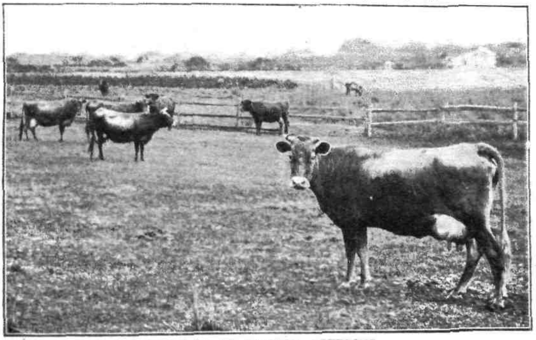
CLOSER SETTLEMENT STUDIES.

A WELL-MANAGED HERD OF COWS.

J. M. B. Connor, Dairy Supervisor.

It is evident that no one system of management can be laid down as a hard-and-fast rule to suit all farms, but, in the economy of the keep of the dairy herd, knowledge of the cardinal rules of breeding, feeding, and caretaking, and discretion in the application of that knowledge to daily practice, are amongst the very first essentials of success.

Messrs. Ralph Brothers, owners of the Hampton Park dairy farm, are, after fifteen years of careful selection and breeding, reaping the benefit of

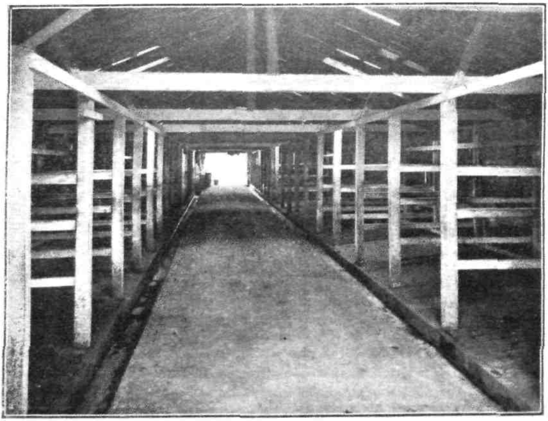


RESULT OF CAREFUL BREEDING.

sound management in building up their present herd of beautiful animals. The farm is situated amongst the heath lands at Hampton, about ten miles S.E. of Melbourne, and within a few minutes of the railway station. The farm contains 195 acres, and is sub-divided into five paddocks, ranging from ten acres to 100 acres. Thirty acres are devoted to a practical system of growing a rotation of fodder crops, by intense cultivation, for summer and winter consumption for the dairy herd, the balance of the land being used for grazing the cows. The soil consists of a black sandy loam, with a limestone subsoil, and in its unimproved condition is thinly covered with bracken fern, heath, and light scrub.

The dairy herd consists of sixty-six cows, which average, when in full swing, ten to twelve quarts daily. At the present time (21st October) there

are fifty-four cows in milk, some of them giving over twenty quarts, yielding 550 quarts daily, which is retailed by four carts daily around Brighton and Sandringham. The cows are in the pink of condition, and are mostly crossbred Ayrshire and Jersey breeds. The present good qualities of the herd have been brought about by always using a pure-bred sire known to be descended from a milking strain on the dam's side, the first bull used to improve the breed being an Ayrshire. His stock was crossed with a pure Jersey bull, and the stock of the latter was re-crossed with an Ayrshire bull, and so on, every four years, re-crossing with these two breeds, and always using fresh blood. Care is always taken to obtain the best that can be purchased from a milking point of view, and it would be very hard to find a more even and nicer lot of dairy cows in the State. They show plenty of breeding, with beautifully shaped milk vessels, 75 per cent. of them being typical dairy cows in every sense of the word; their udders



INTERIOR OF MILKING SHED.

extend well forward along the belly, with plenty of width behind, and fill up every available space between the hind legs; the fine sloping fore quarter, razor-like wither, deep chest and body, with well-sprung hoop-like ribs, allowing plenty of room for storage of food, are all markedly manifest in this herd. This latter is an important point to note in buying a dairy cow, for if she has not the capacity for storing food, it is not to be expected that she can return large quantities of milk. The necessity of having good teats has not been lost sight of, and the whole herd is very uniform in this respect. They are rich brown in colour, the thickness being in proportion to the length of the teat, about 2½ inches. I noticed the legs short in comparison to the size of the bodies. Kind treatment and good feeding are features of management which inevitably rise to mind when looking at this docile, mellow, and sleek-coated herd of cows.

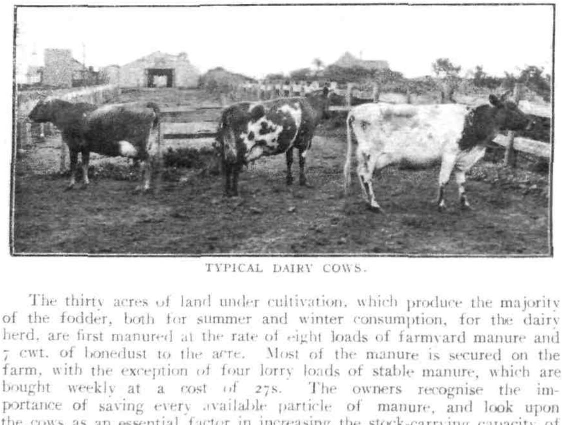
The milking shed consists of 37 bails, 4 feet wide by 8 feet long, with a 10-feet passage running down the centre, and a well-drained impervious brick floor laid in cement, drained on either side of the passage by a drain 12 inches wide by 3 inches deep, made of red-gum. The drainage runs into a large iron tank, which is emptied three times a week, and utilized in forcing the fodder crops. The shed is well lighted and ventilated by six glass windows along the roof, and one window at each end. It is lime-washed, and the floor is sprinkled daily with lime. Precautions are taken to keep the milk free from contamination. There is one lad employed to do nothing else but to feed the cows and wash their udders with warm water, and dry them. Between the milking of every two cows the men wash their hands, and the boy frequently changes the warm water; this is a treat to witness after the so-called fashion one daily sees on various dairy farms, where this important part

READY FOR DELIVERY.

of the business is carried out with about a gallon of water in a bucket or billy-can, as the case may be, which is used right throughout the milking without changing the water. Is it any wonder to find, when this dirty habit is practised, that sore teats are prevalent? It is the one sure way of carrying out unscientific inoculation of any disease one cow might be suffering from throughout the whole herd. No leg-ropes are used. Milking starts at 5 a.m., and about 4 p.m.; as soon as the milk is drawn from the cows, it is strained into 10-gallon cans, which are immediately taken away and placed in eight wooden vats, adjoining the ice-room, containing spring water from a well 45 feet deep. The cans remain in this cold water for half an hour. The vats are refilled at intervals; the water is pumped from the well into large iron tanks overhead by means of a 4-h.p. engine,

and is so cold that the pipes soon start to drip like a freezer. The milk is then stood in an ice-room ready for delivery. The same engine is used for scalding and steaming all buckets and milk cans, lifting water, cutting chaff, pulping and slicing mangolds, pumpkins, and carrots.

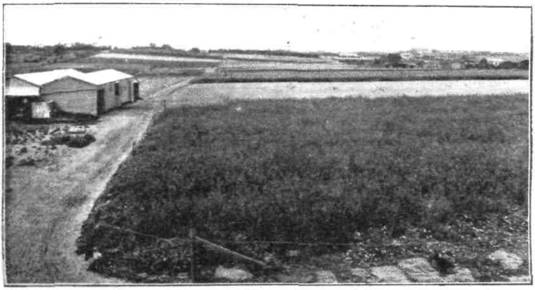
The owners are quite satisfied that the system of slicing and pulping all the roots gives the best results, and that there is no waste. The only feed purchased outside of what is grown on the farm works out at, on an average, 1s. 9d. per cow per week in the way of grains, and sometimes oat hulls. The process of feeding the cows is one bucketful of mixed chaff and grain first, then one bucketful of pulped mangolds, turkscaps, pumpkins, or whatever crop happens to be in season. This plan of feeding is adopted on account of the cows being so fond of the pulped roots that if this was fed first the chances are they would not look at the grains and chaff. The heifer calves, which look well, are all reared on skim milk, fed by the owners themselves. The milk is first scalded to 160 degrees Fah., and when cooled to 100 degrees is fed to the calves. They get nothing else—one gallon in the morning and about a quart at night. The owners are careful not to allow the calves to gorge themselves; their idea is to keep the calves growing, not to fatten them.



TYPICAL DAIRY COWS.

The thirty acres of land under cultivation, which produce the majority of the fodder, both for summer and winter consumption, for the dairy herd, are first manured at the rate of eight loads of farmyard manure and 7 cwt. of bonedust to the acre. Most of the manure is secured on the farm, with the exception of four lorry loads of stable manure, which are bought weekly at a cost of 27s. The owners recognise the importance of saving every available particle of manure, and look upon the cows as an essential factor in increasing the stock-carrying capacity of their farm, by supplying most of the manure required to keep up the fertility of the cultivation ground. The land is then deeply ploughed and broken up, and brought to a fine tilth. The last twelve months' crops consisted of the following:—Five acres of potatoes, planted during February for spring seed, and dug about May, and packed in fruit cases, so as to allow of free circulation of air, which causes the potatoes to shoot better, and the greener they turn in colour the better for seed; 8 acres of potatoes, planted on the 21st day of June, and dug at Christmas time, and fed to cows if selling cheaply; 3 acres of carrots (white Belgiums),

sown in September, in drills 2 ft. 6 in. apart and about 3 inches between each plant—these were pulped and fed to the cows during the months of May, June, and July, and returned 100 tons weight to the 3 acres; 10 acres mangolds, 20 tons to the acre (long red and yellow globe), the long reds were ready to start to feed in June, and the yellow globe fed through the spring and gave good results; 15 acres of maize (90 day), which is sown early in September and afterwards at intervals of every two weeks, so as to avoid the crop all ripening and coming in at the one time—it is ready for feeding purposes in January, and is fed (chaffed up with other foods) right up to end of May; 6 acres of rye, put in in February, and chaffed with other foods in season during September and October; 10 acres of oats and barley (5 acres of each), sown in March, and fed to the cows during October and November; 1 acre of Japanese millet (tried for the first time, and gave great satisfaction, all animals being very fond of it) was sown in October, and fed to the animals during January and February, and gave very heavy yield of bulky fodder. Two acres of maize, which grew to a height of 9 feet, were irrigated; this area was



FODDER CROPS.

sown at the rate of 1 bushel to the acre; drilled in every third furrow by hand with a drag hoe, and covered about 2 inches deep. This method has proved to be the best one for sowing maize, as it comes up uniformly, and allows the horse hoe to be worked between the rows to keep the surface soil free and open, keeping down weeds and conserving the moisture. This crop was irrigated at the cost of £10 for the season, and fed to the animals from January to the end of March. The owners assured me that two loads of the green succulent fodder at that trying time of the year more than compensated them for the expense they were put to for water rates, by allowing them to keep up the regular milk supply and the dairy herd in tip-top condition and good health.

Everything in the way of tinware used on the farm or coming into contact with the milk is thoroughly sterilized by steam, there being an elevated table with a steam jet in the centre; cans and buckets are tipped over this, and afterwards allowed to drain in a clean room set apart for that purpose.

STATISTICS.

Rainfall in Victoria.

THIRD QUARTER, 1906.

TABLE showing average amount of rainfall in each of the 26 Basins or Regions constituting the State of Victoria for each month and the quarter, with corresponding monthly and quarterly averages for each Basin deduced from all available records to date.

Basin.	July.		August.		September.			
	Amount, 1906.	Average.	Amount, 1906.	Average.	Amount, 1906. *	Average.	Total for Third Quarter. *	Average for Third Quarter.
Glenelg and Wannon Rivers	5.21	2.91	3.31	3.10	2.38	2.71	10.90	8.72
Fitzroy, Eumerella, and Merri Rivers	5.32	3.37	3.43	3.19	2.88	3.08	11.63	9.63
Hopkins River and Mount Emu Creek	3.90	2.29	2.70	2.43	2.16	2.55	8.76	7.27
Mount Elephant and Lake Corangamite	4.45	1.90	2.34	2.34	2.80	2.39	9.59	6.63
Otway Forest	5.74	3.68	4.59	4.01	2.92	3.52	13.25	11.21
Moorabool and Barwon Rivers	3.05	2.31	3.04	2.38	3.46	2.60	9.55	7.29
Werribee and Saltwater Rivers	1.66	2.11	2.35	2.48	4.31	2.39	8.32	6.98
Yarra River and Dandenong Creek	3.39	3.10	3.18	3.06	3.67	3.26	10.24	9.42
Koo-wee-rup Swamp ...	3.90	2.94	3.25	2.94	3.58	3.26	10.73	9.14
South Gippsland	5.16	3.41	4.12	3.95	2.43	3.66	11.71	11.02
La Trobe and Thomson Rivers	3.89	2.71	3.65	3.53	1.75	3.36	9.29	9.60
Macallister and Avon Rivers	0.81	1.53	3.39	2.45	0.46	2.08	4.66	6.06
Mitchell River	0.98	1.91	3.30	2.65	2.02	2.33	6.30	6.89
Tambo and Nicholson Rivers	0.86	2.20	2.86	2.61	1.31	2.15	5.03	6.96
Snowy River	1.24	3.44	2.82	3.27	1.07	3.56	5.13	9.77
Murray River	1.99	1.86	2.40	2.26	3.10	1.83	7.49	5.95
Mitta Mitta and Kiewa Rivers	4.59	3.11	3.19	3.3[illegible]	4.29	3.05	12.07	9.49
Ovens River	5.03	3.89	3.18	4.29	4.05	3.99	12.26	12.17
Goulburn River	3.33	2.34	2.80	2.83	3.89	2.31	10.02	7.48
Campaspe River	3.04	2.24	2.38	2.69	6.63	2.18	12.05	7.11
Loddon River	2.22	1.48	2.05	1.92	3.98	1.54	8.25	4.94
Avon and Richardson Rivers	1.97	1.28	1.69	1.68	2.03	1.33	5.69	4.29
Avoca River	1.96	1.42	1.84	1.74	1.88	1.35	5.68	4.51
Western Wimmera ...	4.22	2.14	2.36	2.27	2.69	1.84	9.27	6.25
Eastern Wimmera	3.21	2.16	2.46	2.37	1.64	1.88	7.31	6.41
Mallee Country	1.44	1.15	1.48	1.37	1.56	1.06	4.48	3.58
The whole State	2.94	2.21	2.59	2.51	2.61	2.21	8.14	6.93

* Figures in these columns are subject to alterations when the complete number of returns for September has been received.

P. BARACCHI,

Government Astronomer.

Perishable and Frozen Produce.

QUARTERS ENDING 30TH SEPTEMBER, 1906 AND 1905 RESPECTIVELY.

Description of Produce.		Exports from the State.		Deliveries from the Government Cool Stores.	
		1906.	1905.	1906.	1905.
Butter	lbs.	5,647,540	4,642,056	3,024,896	2,401,392
Cheese	"	235,080	180,120	44,078	...
Ham and Bacon ...	"	486,000	399,600	...	...
Milk and Cream	cases	4,043	4,715	160	25
Poultry	head	18,270	10,230	3,705	3,809
Eggs...	dozen	11,358	7,356	2,903	3,000
Mutton and Lamb	carcasses	8,937	24,421	5,504	10,980
Beef	quarters	2,065	159	...	...
Veal	carcasses	1,666	2,945	90	72
Pork... ...	"	745	173	497	43
Rabbits and Hares	pairs	1,793,548	2,023,440	478,440	687,496
Fruit	cases	7,483	7,836	835	42
" Pulp ...	"	839	372	...	...
Kidneys ...	dozen	...	...	...	820
Sundries ...	lbs.			6,537	3,177

R. CROWE,
Superintendent of Exports.

Fruit, Plants, Bulbs, Grain, &c.

IMPORTS AND EXPORTS INSPECTED DURING THE QUARTER ENDED 30TH SEPTEMBER, 1906.

Fruit, &c.	Imports.		Exports.		Fruit, &c.	Imports.		Exports.	
	Australasian.	Oversea.	Australasian.	Oversea.		Australasian.	Oversea.	Australasian.	Oversea.
Apples ...	13,089	20	369	225	Plants ...	392	100	127	—
Bananas, b's.	83,184	—	—	—	Bulbs ...	—	158	—	—
Bananas, c's.	3,870	1,713	854	—	Barley ...	6,144	—	—	—
Cucumbers	730	—	56	—	Beans ...	74	1,183	—	—
Lemons ...	10,912	—	—	232	Maize ...	3,159	—	—	—
Loquats ...	63	—	—	—	Nuts ...	117	960	—	—
Melons ...	—	—	70	—	Nutmegs ...	—	80	—	—
Mixed fruits	78	—	—	—	Oats ...	154	—	—	—
Oranges ...	181,785	—	2,248	80	Peas ...	1,149	20	—	—
Passion fruit	1,760	—	205	—	Potatoes ...	1,005	45	—	—
Pears ...	—	—	167	—	Rice ...	—	21,297	—	—
Persimmons	—	—	2	—	Seeds ...	767	45	—	—
Pineapples	6,885	—	533	—	Wheat ...	—	340	—	—
Plums ...	—	21	—	—	Yams ...	—	124	—	—
Strawberries	468	—	—	—					
Tomatoes ...	2,091	—	25	—	Totals ...	317,876	26,106	4,656	537

J. G. TURNER,
Inspector, Vegetation Diseases Acts, and Exported Products Act

THE ORCHARD.

James Lang, Harcourt.

The usual routine work of the orchard should be pushed on; keep the scarifier going so that weeds may be destroyed and the surface kept loose and open. From reports to hand from various parts of the State, the fruit crop on the whole promises to be an average one. Frosts in the Bendigo and Castlemaine districts have destroyed a quantity of fruit, especially in those orchards which are situated on the banks of creeks and other low situations, consequently the average in these localities will be reduced. Complaints are also being made about the non-setting of the London Pippin; this is one of those varieties which bloom late, and is therefore in danger of being caught when in bloom by the hot winds. This happened last year, when the hot wind on Cup day destroyed the whole of the crop; it also happened this year, although not to the same extent, and owing to this cause there will be an extremely light crop of this variety all over the State. Pears are an average crop. William's Bon Chretien especially being a good crop; but peaches, apricots, and plums are below the average.

Reports of an unusual number of trees—cherries, apricots, and peaches—dying, have come to hand. This is no doubt caused by the exceptionally wet winter experienced north of the Dividing Range; in many orchards the roots of the trees were standing in water during the latter part of the winter. This shows the necessity for thorough drainage to carry off the stagnant water from the roots of the trees.

Spraying for the codlin moth will take up a good deal of time during the month. The arsenite of lead spray* is being greatly used in the Bendigo and Castlemaine districts, and seems to give satisfactory results to those growers who use it.. It is claimed for this spray that it does less injury to foliage than any other of the many arsenical sprays in use. The foliage of trees that are affected with red spider is more susceptible to burning than where the foliage is healthy. This can sometimes be seen on the same tree—where a branch is badly affected with red spider the leaves are burnt with the spray, while on the other parts of the tree not so affected, the foliage is clean and healthy, and the spray has no effect on it. The red spider does more damage and causes more loss in the orchard than many growers are aware of. The bandages on trees should be frequently looked over, and all codlin grubs destroyed. It will also be necessary to secure the young grafts on newly-grafted trees by tying them to stakes or by other means to prevent them from being blown off by the wind.

* See article on page 729.

The Index of Vol. IV. will be supplied with the first number of Vol. V. viz.:—8th January, 1907.

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